Summer Learning Loss in Reading Achievement:

Effects of Demographic Variables and Summer Activity

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Abstract

The purpose of this dissertation was to determine if there was a statistically and practically significant effect of summer learning loss in reading in primary grades, and to determine whether or not that loss varied by demographic variables and/or summer activity. The first study examined if demographic variables such as free or reduced lunch status, special education status, eligibility for English Language Learner services, or race influenced summer learning loss. The second study controlled for significant demographic variables and determined if summer literacy activities at home, as measured by a survey, or summer program attendance were associated with differential summer learning loss. Based on recommendations in previous literature, intervening instructional time was minimized and students were tested within the last 10 days of school in the spring and the first 10 days in the fall. There was a significant effect of summer learning loss in reading in four of the six grades studied, and in those grades, the effect size of the loss was medium to large in magnitude (i.e., d = .52 – 1.37). Demographic variables and summer activity, as measured by the present study, accounted for a small proportion of the variance in summer change.

Keywords: summer learning loss, summer slide, summer regression

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CHAPTER 1

Education is a universal intervention provided to all children to promote academic and social development (Deno, 2005). Most schools in the United States provide formal schooling for nine months of the year, and do not provide education over the summer months, resulting in a withdrawal of intervention. Research from the early 1900s (e.g., White, 1906; Garfinkel, 1919; Brueckner & Distad, 1924) began to investigate the trajectory of academic achievement over the summer months. Such research observed a negative trend in achievement for various students. This trend has been termed "summer learning loss" (Cooper, 2003), "summer setback" (Allington et al., 2010), or "summer slide" (Slates, Alexander, Entwisle, & Olson, 2012). This paper uses the term *summer learning loss*, which is defined as the decline in achievement over the summer months when formal school-based instruction is withdrawn for most children; the focus is further refined to summer learning loss in reading achievement in the primary grades. The introduction will discuss the importance of better understanding the phenomena of summer learning loss in reading. First, there is a focus on students who are low achieving within general education. Second, there is a focus on extended school year services for students who receive special education services. These foci provide emphases on the influence of summer learning loss on distinct groups. Such insights might guide future interventions to reduce gaps in opportunity and achievement. Third, there is an integrated summary of findings and issues raised in an important prior review of summer learning loss (Cooper, Nye, Charlton, Lindsay, & Greathouse, 1996). Together, these issues provide a robust foundation for current and future research to explore the current influence and future potential of summer activities to reduce gaps in opportunity and achievement.

Reading in General Education

Summer learning loss in reading achievement may have a negative effect on students who are already struggling to catch up to their peers. If children have not learned to read early on, they are unlikely to transition to a state of reading-to-learn in later grades (Chall, 1983). Longitudinal research found that poor readers in first grade are unlikely to acquire average-level reading skills during elementary school (Juel, 1988; Torgesen & Burgess, 1998).

Policies at the local, state, and national level regularly focus on reading (Bryant et al., 2000) because reading is of the utmost importance for future success. Reading skills in first, third, and fifth grades predict various outcomes in high school. For example, early reading achievement predicts reading comprehension, written vocabulary, and general knowledge in 11th grade (Cunningham & Stanovich, 1997). Low reading proficiency is also associated with low rates of high school graduation or completion (Hernandez, 2011). Below-basic readers are at greater risk for school dropout; 23% of below-basic readers in third grade drop out of high school or fail to graduate on time (Hernandez, 2011).

If children fall behind their peers in early reading achievement, they have less opportunity and desire to practice reading. Better readers are more motivated to read, and thus tend to read more. This in turn increases vocabulary, allowing good readers to become even better readers (Pfost, Hattie, Dörfler, & Artelt, 2014). The reason that students struggle to catch up to proficient reading levels remains unclear. One hypothesis is that students are not making enough academic progress during the school year. An alternate hypothesis is that the difficulty could be caused by academic skill loss from a lack of instruction over summer months, which then must be made up in the next academic year. A third possibility is a combination of effects from the school year and from summer learning loss.

Extended School Year Services

To prevent summer learning loss among students with disabilities, schools are required to identify which students are susceptible to summer loss and enroll them in extended school year (ESY) services. Students are eligible for ESY services if extended academic instruction is a necessary component of an educational program designed to educationally benefit the student (Individuals with Disabilities Education Improvement Act, 2004). ESY services are provided as part of the free and appropriate public education to which all students with disabilities are entitled (Jacob, Decker, & Hartshorne, 2011). Federal law, however, provides little guidance on how to determine which students were most likely to experience summer loss. The results of a survey sent to directors of special education in all 50 states found that the responsibility for determining ESY eligibility was most often delegated to the individualized education program (IEP) team (Katsiyannis, 1991). Across the country, approaches varied by existence of state policy or legislation on ESY, time of year that ESY eligibility was determined, and existence of timelines for ESY eligibility decisions (Katsiyannis, 1991). Common criteria for eligibility included regression/recoupment, severity of disability, individual needs, and the capacity of parents to monitor acquired skills (Katsiyannis, 1991). These disparate approaches and differences between state policies lead to inconsistency in determining ESY eligibility.

The regression-recoupment standard is a common determinant of ESY eligibility (Etscheidt, 2002). Court decisions established that the regression-recoupment standard is satisfied when there is evidence that the student will substantially regress in skill over the summer without educational services, and that there will be a period of recoupment over the following school year (*Cordrey v. Euckert*, 1990; *Reusch v. Fountain*, 1994). However, empirical data are not necessary to establish a need for ESY services (*Cordrey v. Euckert*, 1990). The decision of the court in *Johnson v. Independent School District No. 4 of Bixby* (1990) determined that loss over previous summers was not required to make ESY decisions, and proposed alternative criteria such as degree of impairment and predicted summer loss. Thus, the regression-recoupment standard may be met through predicted loss or expert opinion that loss is likely to occur (Jacob et al., 2011). In a review of 57 ESY service cases, the regression-recoupment factor was found to be the determining factor in cases where ESY services were awarded (Etscheidt, 2002). More specifically, cases examined whether the student was at risk for serious loss over the summer, and/or whether the lost skill would be recouped within the first six weeks of the following school year (Etscheidt, 2002). Although recommended by case law decisions, it is exceedingly difficult for school personnel to make decisions regarding regression-recoupment. This is exacerbated by a lack of methodologically sound research demonstrating which students are most susceptible to summer learning loss, the extent of the loss, and the time it takes to recoup skills in the fall.

Summer Learning Loss In Reading

Cooper and colleagues (1996) concluded that there was an average effect of summer learning loss in reading, though the results of the included studies varied widely. The authors conducted a review of literature prior to 1975 and a meta-analysis of 13 studies between 1975 and 1994 to examine summer learning loss in reading, spelling, and math computation. In the 11 studies prior to 1975, all showed summer learning loss in spelling but only 7 of 17 samples revealed summer learning loss in reading comprehension (Cooper et al., 1996). By comparison, all 17 studies of math computation prior to 1975 indicated a loss in math over the summer months (Cooper et al., 1996). The results of the meta-analysis supported the pre-1975 conclusions; the unweighted effect size for summer learning loss in math (d = -.14) was much larger than the unweighted effect size of reading loss (d = -.05; Cooper et al., 1996). Homogeneity analyses indicated that the difference in effect size between subjects was greater than would occur by chance (Cooper et al., 1996).

Cooper and colleagues' (1996) meta-analysis noted issues regarding the measurement of summer learning loss. One issue was the length of the summer interval; summer vacations vary in length, and many studies of summer loss include instructional time in the "summer" period, which makes estimates of loss conservative. The summer interval and inclusion of instructional time in the summer period is a pervasive issue in the field. Cooper and colleagues (1996) reported that the interval between spring and fall tests ranged from 92 to 153 days. Longer summer intervals were associated with more summer gains for both math and reading (Cooper et al., 1996). Thus, the authors concluded that the longer summer intervals likely contained more instructional time, which mitigated the negative effects of the lack of instruction over the summer and confounded the measurement of loss (Cooper et al., 1996). The authors called for future research to test in such a way as to minimize the inclusion of instructional days in the summer interval, and cautioned that their estimate of one month of skill loss over the summer was conservative due to the inclusion of instructional time (Cooper et al., 1996). In this paper, the term *intervening instructional days* refers to instructional days during the typical school year that are included in between spring and fall measurements and therefore included in the “summer” interval. Summer school outside of the typical school year is not considered intervening instructional time.

The Cooper and colleagues (1996) study served as a foundational study in the field of summer learning loss research. The authors identified common moderating variables such as IQ, family income, race, and grade level (Cooper et al., 1996). Research has yet to conclusively determine which students are most susceptible to summer learning loss by empirically evaluating these and other moderators. Furthermore, summer learning loss research rarely evaluates mediating effects of summer activity, such as reading at home or attending summer camp. By assessing moderators and mediators of summer learning loss, educators will be better equipped to determine who is most susceptible to summer learning loss, and in what subject. Finally, accounting for intervening instructional days through score adjustment or minimizing intervening instructional days when testing can provide more precise estimates of loss, and help inform decisions in schools related to extended school year eligibility and service delivery. This paper aims to address these issues, and they will be further discussed in chapters 2 and 3.

Risk and Protective Factors

Identifying risk and protective factors related to academic success has been a major area of study, as understanding these factors is believed to provide better understanding of student success. Better understanding of risk and protective factors allow educators to increase academic success of at-risk students and better meet their academic needs (Christiansen, Christiansen, & Howard, 1997). The risk and resilience framework is supported by research of various methodologies (Corcoran & Nichols-Casebolt, 2004). Recently, researchers have applied the risk and resilience framework to intervention (Corcoran & Nichols-Casebolt, 2004). To date, however, the risk and resilience framework has not been utilized to better understand the phenomenon of summer learning loss. More specifically, research has not yet clearly determined factors that may increase or mitigate risk of summer learning loss in reading. The two studies in this dissertation examine potential risk factors (e.g., free or reduced lunch status, English language learner status, special education eligibility) and protective factors (e.g., home literacy activities, summer programs) that may be related to summer learning loss.

Purpose

The purpose of these two studies was to extend upon previous research on summer learning loss, including refinements to the research design that fully accounted for intervening instructional days. The studies also included a refined focus on demographic influences and differences in initial (pre-summer) levels of achievement.

The purpose of the first study was to estimate the magnitude and significance of summer learning loss within the general population and by demographic characteristic, such as free or reduced lunch (FRL) status, English language learner (ELL) status, and special education (SPED) status. The second study, after controlling for FRL status and other significant variables from the first study, aimed to estimate the influences of various summer activities, such as library visits and summer school attendance.

This two-study dissertation was intended to inform policy makers, educational leaders, educators and researchers who might consider the use of summer activities to reduce gaps in opportunity and achievement. At the outset of this study, these issues seemed especially salient for individuals with deficits or disabilities in reading.

CHAPTER 2: EFFECT OF DEMOGRAPHICS ON SUMMER LEARNING LOSS

Summer learning loss of reading achievement has two major consequences. First, affected students lose previous gains in reading over the summer. Second, they spend valuable instructional time in the fall attempting to regain the lost skill. According to the National Assessment of Educational Progress (NAEP), although reading proficiency has increased since 1992, it did not increase from 2013 to 2015 (U.S. Department of Education, 2015). *Proficient* is one of three achievement levels and represents solid performance in the grade-level academic skill assessed (U.S. Department of Education, 2015). For example, for a fourth grade student to score in the *Proficient* level in reading, he or she should be able to integrate and interpret passages and apply the content to answer questions requiring evaluation of the written content (U.S. Department of Education, 2015). Eighth grade students must demonstrate the ability to summarize main ideas and themes of text, make and justify inferences, and analyze features of texts to score in the *Proficient* range (U.S. Department of Education, 2015). In 2015, 36% of fourth grade and 34% of eighth grade students performed at or above the *Proficient* level in reading (U.S. Department of Education, 2015). The average reading score of fourth grade students did not significantly change from 2013 to 2015, while the average reading score of eighth grade students dropped from 268 in 2013 to 265 in 2015, a statistically significant change (U.S. Department of Education, 2015). The lack of improvement is attributable to many causes, but instructional time spent to regain lost skills over time does not seem to be increasing the proportion of students reading at the proficient level.

There is a need to increase the proportion of students reading at a *Proficient* level, especially when considering the importance of reading for future success.

Reading skills in first, third, and fifth grades predict a variety of academic outcomes in 11th grade (Cunningham & Stanovich, 1997). After controlling for aptitude, early reading performance is highly predictive of reading comprehension, written vocabulary, and general knowledge in 11th grade (Cunningham & Stanovich, 1997). Low reading proficiency is also associated with lower rates of high school graduation or completion (Hernandez, 2011). One in six children who are not proficient readers in third grade do not graduate from high school on time (Hernandez, 2011). Reading is a foundational skill, and there is a clear need for an increase in the proportion of students reading at a proficient level. Reducing summer learning loss may be one way to address this need.

Results of a Systematic Literature Review

The author completed a systematic literature review of summer learning loss using the same search terms as the meta-analysis conducted 20 years ago (Cooper et al., 1996), but added *summer learning loss* and the Boolean search term *read**. The systematic review yielded 15 original empirical studies since 1994 that were not included in Cooper and colleagues' study. Nine of the 15 studies (60%) controlled for intervening instructional time (viz., Allinder & Eicher, 1994; Atteberry & McEachin, 2015; Burkam, Ready, Lee, & LoGerfo, 2004; Downey, Von Hippel, & Broh, 2004; Henry et al., 2003; LoGerfo, Nichols, & Reardon, 2006; McCoach, O'Connell, Reis, & Levitt, 2006; Ready, 2010; Sandberg Patton & Reschly, 2013). Eight of the 15 studies (53%) included in the review reported an average effect of summer learning loss in at least one grade studied (viz., Allinder & Eicher, 1994; Atteberry & McEachin, 2015; Henry et al., 2003; Lawrence, 2009; Lawrence, 2012; Lawrence, Rolland, Branum-Martin, & Snow, 2014; LoGerfo et al., 2006; Sandberg Patton & Reschly, 2013). Of the seven studies that did *not* report an average summer learning loss in at least one grade, four (57%) controlled for instructional time (viz., Burkam et al., 2004; Downey et al., 2004; McCoach et al., 2006; Ready, 2010) and three (43%) did not (viz., Alexander, Entwisle, & Olson, 2001; Helf, Konrad, & Algozzine, 2008; Rambo-Hernandez & McCoach, 2015). Four studies controlling for instructional time did not report an average effect of summer learning loss; however, all four used Early Childhood Longitudinal Study, Kindergarten class of 1998-1999 (ECLS-K) data and only examined one summer (viz., Burkam et al., 2004; Downey et al., 2004; McCoach et al., 2006; Ready, 2010). Three studies examining solely vocabulary did not control for intervening instructional time but did observe an average effect of summer learning loss (viz., Lawrence, 2009; Lawrence, 2012; Lawrence et al., 2014). Thus, five of the eight studies (63%) that reported an average effect of summer learning loss in reading adjusted for intervening instructional days (viz., Allinder & Eicher, 1994; Atteberry & McEachin, 2015; Henry et al., 2003; LoGerfo et al., 2006; Sandberg Patton & Reschly, 2013). Of the seven studies that reported no average effect of loss, four (57%) used the ECLS-K dataset (viz., Burkam et al., 2004; Downey et al., 2004; McCoach et al., 2006; Ready, 2010) and three (43%) did not account for intervening instructional days (viz., Alexander et al., 2001; Helf et al., 2008; Rambo-Hernandez & McCoach, 2015). Varied results make it difficult to assess the impact that the research methodology has on findings of loss. Nevertheless, the results of the review indicated that studies that account for intervening instructional time are more likely to find loss over the summer. Adjusting for intervening instructional time seems to have a greater impact than the type of measurement used. The studies were also coded for variables included in analysis. The results for SPED status, socioeconomic status (SES), and ELL status are discussed below.

Special education status. Three of the 15 studies (20%) examined summer learning loss in students with IEPs (viz., Allinder & Eicher, 1994; Lawrence et al., 2014; Sandberg Patton & Reschly, 2013). One study included only students eligible for SPED, and found an average loss over the summer after grades 2 through 5 (Allinder & Eicher, 1994). The authors reported that students had fully recouped summer loss in oral reading fluency six weeks into the fall of the following school year (Allinder & Eicher, 1994). A study of vocabulary in middle school students in grades 6 through 8 found no pronounced differences between summer learning loss of students in SPED and students in general education (Lawrence et al., 2014). The final study that included SPED status found a significant effect only for the summer learning loss after grade 2, but not in grades 3 through 5 (Sandberg Patton & Reschly, 2013). Second grade students eligible for special education lost 10 words read correctly over the summer, while general education students in second grade lost just four words read correctly (Sandberg Patton & Reschly, 2013).

Although summer learning loss was significantly different for students in SPED only in second and third grades, there was a significant between-subjects effect of special education, such that students with IEPs scored lower in both the spring and fall than students without IEPs in grades 3, 4, and 5 (Sandberg Patton & Reschly, 2013). It should be noted that the number of students eligible for special education was small; by calculating the average percentage of special education students (12.5%) by the number of students in each grade, an estimated 10 special education students were included in analyses for second grade, 11 in third and fifth grade, and 8 in fourth grade (Sandberg Patton & Reschly, 2013). Although Allinder and Eicher (1994) had slightly larger special education populations, the numbers were still small, ranging from 17 participants in second and third grade to 23 in fifth grade. Lawrence et al. (2014) included the largest sample of students with IEPs, ranging from 324 in wave 2 to 175 in wave 4, though the students were separated by treatment and control and only vocabulary loss was assessed (Lawrence et al., 2014). In summary, one study found that, on average, students with IEPs in grades 1-4 exhibited summer learning loss in oral reading fluency (Allinder & Eicher, 1994). A more recent study found the effect only in the summer after grade 2 (Sandberg Patton & Reschly, 2013). Finally, SPED status did not significantly impact summer loss of vocabulary skills in middle school (Lawrence et al., 2014). While these findings appear somewhat contradictory, the two studies that examined the effect of SPED status on oral reading fluency (viz., Allinder & Eicher, 1994; Sandberg Patton & Reschly, 2013) utilized small sample sizes from a single school district, which impede generalizability of results.

Socioeconomic status. SES was the most common moderator included in analyses; nine of the 15 (60%) articles included in the review examined summer learning loss by SES (viz., Alexander et al., 2001; Burkam et al., 2004; Downey et al., 2004;

Henry et al., 2003; Lawrence, 2012; LoGerfo et al., 2006; McCoach et al., 2006; Ready, 2010; Sandberg Patton & Reschly, 2013). All but one study (93%; Lawrence, 2012) reported differential summer learning loss by SES. Lawrence (2012) reported no difference in summer learning loss of vocabulary between middle school students eligible for FRL and those ineligible, but recognized that this may not be the best proxy for SES (Harwell & LeBeau, 2010). Furthermore, the majority of the sample (88.1%) was eligible for the FRL program, an indication of homogeneity in the sample that may have impacted findings (Lawrence et al., 2014). Lawrence and colleagues (2014) noted that it was not clear if the sample was as income-heterogeneous as typical samples.

Henry and colleagues (2003) found that students from Head Start programs lost more than students from pre-kindergarten and private preschools. The study did not directly group students into high, medium, and low SES groups; however, the average annual income of the Head Start group ($20,000-30,000) was lower than that of the pre-kindergarten ($40,000-50,000) or private preschool ($60,000-70,000) groups (Henry et al., 2003). The Head Start group also had higher levels of Medicaid use and greater rates of mothers and fathers with less than a high school degree than the pre-kindergarten or private preschool groups (Henry et al., 2003).

Five ECLS-K studies concluded that low-SES students exhibited summer learning loss while high-SES exhibited summer gains between kindergarten and first grade (viz., Burkam et al., 2004; Downey et al., 2004; LoGerfo et al., 2006; McCoach et al., 2006; Ready, 2010). However, the size of the effect was small (ES = -.02; LoGerfo et al., 2006). Still, the gap between high-SES and low-SES students decreased over the academic year and widened at the rate of .0046 points per month in the summer (Ready, 2010), with the result that each month of summer was associated with an effect size of .10 (Burkam et al., 2004).

A similar pattern was found for the summers after first and second grades (Alexander et al., 2001). School year growth rates did not vary by SES, but summer rates varied substantially, with high-SES students scoring above low-SES students over the summer (*ES* = .40; Alexander et al., 2001). In a study of grades 2-5, the effect of SES (as indicated by FRL status) on summer growth was significant only for the summer after second grade (Sandberg Patton & Reschly, 2013). In the summer after second grade, students eligible for FRL lost seven words read correctly while ineligible students gained two words read correctly.

The ECLS-K studies provide strong evidence for an effect of SES on summer learning loss in reading in kindergarten (viz., Burkam et al., 2004; Downey et al., 2004; LoGerfo et al., 2006; McCoach et al., 2006; Ready 2010). There is also evidence of such an effect in the summer after pre-kindergarten (Henry et al., 2003), first (Alexander et al., 2001) and second grades (Alexander et al., 2001; Sandberg-Patton & Reschly, 2013). However, at least when measured by FRL status, SES did not significantly impact the learning loss of middle school students on vocabulary tests (Lawrence, 2012). Thus, FRL status or SES may have a larger effect on summer learning loss in reading during elementary school.

English language learner status. Only three of the 15 studies (20%) included any language variable into analysis, such as limited English proficiency status or whether the student came from a non-English speaking home (viz., Lawrence, 2012; LoGerfo et al., 2006; Sandberg Patton & Reschly, 2013). Lawrence (2012) reported that students from non-English speaking homes exhibited greater summer vocabulary loss than peers from English-speaking homes, even after controlling for the effects of FRL status and summer reading activity. In contrast, although not discussed in text, a table indicated that students from non-English speaking homes (*ES* = .011) gained .15 points per month more than students from English speaking homes the summer after kindergarten (*ES* = -.02; LoGerfo et al., 2006). For reference, the average student gained 1.81 points per month during kindergarten, with a mean score of 22.75 in the fall of kindergarten (LoGerfo et al., 2006). The third study found no significant effect of ELL status in any grade studied (Sandberg Patton & Reschly, 2013).

Purpose

The purpose of this study was to extend upon previous research on summer learning loss (Cooper et al., 1996), including refinements to the research design that fully accounted for intervening instructional days. It also included a refined focus on demographic influences and differences in initial (pre-summer) levels of achievement. The study addressed the following questions: a) what is the significance and magnitude of summer learning loss within the primary grades; and b) how is summer learning loss influenced by demographic characteristics, such as SPED status, FRL status, or ELL status? It was expected that a portion of participants would demonstrate a meaningful loss over the summer and that students eligible for SPED, FRL, and ELL services would be more susceptible for summer learning loss.

Methods

Participants and Setting

The participants in this study were 649 students in grades kindergarten (n = 56), first (n = 83), second (n = 160), third (n = 90), fourth (n = 101) and fifth (n = 159) grades. 657 students (84.6%) who were tested in the spring were re-tested in the fall (15.4% attrition). Note that students are referred to by their grade in the spring 2016. All students attended one of three schools (37 classrooms in spring 2016) in a suburban school district in the Midwest (see Table 1 for demographics by school and district). The demographic information for the participant sample is included in Table 2. Overall, the sample was 49.6% male, and the racial/ethnic composition was: 33% White, 30.5% Asian, 20% Black, 14.8% Hispanic, and 1.7% Hawaiian or Pacific Islander. Of the overall sample, 62.9% were eligible for FRL, 21.9% were designated as ELL, and 10.6% were receiving SPED services. Each student was tested once in the spring of the 2015-16 school year and once in the fall of the 2016-17 school year. All testing occasions occurred during the final nine days of instruction in the spring, and the first nine days of instruction in the fall.

Parents of students in the study schools were given the opportunity to opt out of the study. Each school determined the sampling methodology in the spring. All students in general education (i.e., not a separate resource room or dual language program) at school one were tested (participation rate of grades K-5 = 60.6%). At school two, teachers were allowed to opt in for the study (participation rate = 30.2%). At school three, all students in general education were tested (participation rate = 42.3%). Two make-up testing days were added to the end of the testing interval to test students that were absent on previous testing days. In the fall, all possible students that were tested in the spring were re-tested.

Measures

FastBridge Learning curriculum-based measures in oral reading (CBM-R) and letter sounds (LS) were used (Christ et al., 2014). CBM-R was a published, standardized, individually administered, norm- and criterion-referenced measure of oral reading fluency (ORF). The administrator read standardized directions that guided the student to read aloud for one minute from each of three successive grade-level passages. The administrator noted any errors. Cloud-based software timed the administration duration and auto-calculated the number of words read correctly per minute (WRCM) and total accuracy. WRCM was used as the outcome variable for analysis. The LS task was similar, but students read letter sounds in place of words. The publisher indicated that LS was the most similar task to CBM-R and was the best approximation of a general outcome measure (GOM; Fuchs & Deno, 1991) for reading achievement in kindergarten (T. J. Christ, personal communication, July 8, 2016). Consistent with the CBM-R procedures, each student identified letter sounds for one minute on each of three successive forms. Letter sounds read correctly per minute (LSCM) and total accuracy were calculated. LSCM was used as the outcome variable for analysis. The median score for each student was used for analysis.

FastBridge Learning CBM-R demonstrated high test-retest reliability, ranging from .88 to .95 from fall to winter (Christ et al., 2014). The predictive validity coefficients of CBM-R with the Dynamic Indicators of Basic Early Literacy Skills

(DIBELS) Next ranged from .74 to .82 (mean time lapse of approximately 35 weeks), and the predictive validity coefficients of CBM-R with AIMSweb reading CBM ranged from .95 to .97 (time lapse of approximately 19 weeks; Christ et al., 2014). Concurrent validity coefficients for CBM-R with the Test of Silent Reading Efficiency and Comprehension (TOSREC) in grades 1-5 ranged from .79 to .86, and concurrent validity coefficients for CBM-R and DIBELS NEXT in grades 1-5 ranged from .92 to .96. High concurrent validity coefficients were also found between CBM-R and AIMSweb (.95-.97) in grades 1-5. Validity coefficients were similar across grades.

Kindergarten participants completed FastBridge Learning Early Reading LS probes (Christ et al., 2014). The test-retest validity coefficients for FastBridge Learning LS ranged from 0.35 from fall to spring screening to 0.92 over a period of two to three weeks (Christ et al., 2014). Letter Sound probes also demonstrated high internal consistency, with a coefficient alpha of .93 for 10 items and .98 for both 30 and 50 items (Christ et al., 2014). The concurrent validity of LS to the Group Reading Assessment and Diagnostic Evaluation (GRADE) was .53 for fall scores (Christ et al., 2014). The predictive validity for LS and GRADE composite score for winter to spring prediction was .63 (Christ et al., 2014).

Inter-scorer Agreement

Inter-scorer agreement was calculated for 20% of the final sample (*n* = 132). The author listened to audio recordings and independently scored those administrations. She marked words or letter sounds as correct or incorrect, and compared that score to that of the field-based data collector for the median probe for each participant. Point by point agreement was calculated for each probe by dividing the number of agreements by the total words read (i.e., agreements plus disagreements) and multiplying by 100. The average median score on inter-scorer agreement was 98.66% (*SD* = 1.49).

Fidelity

Procedural fidelity was assessed with the *Observational Rating of Administrator Accuracy* (ORAA; Christ et al., 2013; see Appendix A) checklist. The author observed all data collectors and noted whether they adhered to the standardized data collection procedures by marking on the checklist if each step was followed. Examples of checklist items include whether the instructions were read, the timer was started at the appropriate time, and the last word was correctly marked. The ORAAs were used for CBM-R and LS observations. The average median score on the fidelity checklist was 98.86 (*SD* = 3.07).

Score Adjustments

Scores were adjusted so that they fell on a common scale to allow for direct comparison. The adjusted scores were calculated using the equations (T. J. Christ, personal communication, December 5, 2016) below, where *x* is the unadjusted score:

1st: $0.557x - 3.77$

2nd: $0.868x + 0.64$

3rd: $0.875x + 6.70$

4th: $1.087x - 5.09$

5th: $0.957x + 13.43$

Variables

Pre-score. Each individual student's pre-score, or spring 2016 score, was used as a predictor variable in the regression. The pre-score variable was a continuous predictor variable.

FRL. FRL status was a dichotomous variable that indicated eligibility. The school district provided data on which students were eligible (1) and which were ineligible (0) for free or reduced price lunch. FRL was used in this study as a proxy for SES. See Table 3 for school and grade-level demographic data for FRL students.

SPED. SPED status was a dichotomous variable that indicated eligibility. The school district provided data on which students were eligible (1) and which were ineligible (0) for special education services. See Table 4 for school and grade-level demographic data for SPED students.

ELL. ELL status was a dichotomous variable that indicated eligibility. The school district provided data on which students were eligible (1) and which were ineligible (0) for English language services. See Table 5 for school and grade-level demographic data for ELL students.

Race/Ethnicity. Race/ethnicity information was provided by the district and included in analysis. It was coded as a dichotomous variable, with values White (0) and non-White (1). See Table 2 for race/ethnicity data by school.

Interactions. Two-way interaction terms were included to identify any significant interactions between two variables and summer change.

Procedure

Training. Graduate students and data collectors for FastBridge Learning were trained to administer and score CBM-R and LS probes. Each data collector was trained in person and provided written instructions to ensure standardized administration. Data collectors also completed an online certification, in which they scored three sample probes using audio files of a student reading aloud. Scores of 95% on the online training were required prior to data collection. The online training also contained a quiz that covered basic information such as when to start the timer and discontinue rules.

The author observed data collectors using a fidelity checklist to ensure standardized directions were given and all procedures were completed accurately. Each data collector was observed using the ORAA. The average median score on the fidelity checklist was 98.86 (*SD* = 3.07). Inter-scorer agreement was calculated using audio recordings for 20% of students in the final sample. The average median score on inter-scorer agreement was 98.66% (*SD* = 1.49).

CBM administration. Each student was screened once in the last two weeks of the school year in the spring and once in the first two weeks of the fall. Data collectors read standardized instructions and told students to do their best reading. Each student in grades 1-5 was provided with three grade-level oral reading fluency passages in the spring, while kindergarten students completed letter-sound probes. In the fall, first graders completed letter-sound probes and students in grades 2-6 completed CBM-R probes. Each student read the three CBM-R probes designated for screening. All passages were timed and students read aloud for one minute, while the data collector noted any errors and the last sound/word read before the end time. The number of letter sounds correct or words read correct was the primary summary data for each probe.

Analysis

Linear multiple regression models were fit for each grade level using *R: A Language and Environment for Statistical Computing software* (R Core Team, 2014). Alternative analyses were considered, including hierarchical linear modeling (HLM). HLM was not used because level one sample sizes of 10 or more are desirable (Snijders & Bosker, 1999), and only two data points were collected per student. Therefore, level two would have to be classroom. Data were collected from just 37 classrooms in the fall across the six grades, which would not allow for between-grade or between-student analysis. Furthermore, small level two sample sizes (i.e., less than 50) lead to biased estimates (Maas & Hox, 2005).

Separate models were run for each grade to allow for more careful comparisons across grades. Change between spring 2016 and fall 2017 CBM-R WRCM or LSCM adjusted[1] scores were outcome variables for all regression models. Pre-scores, or spring 2016 scores, were included as a predictor variable in the model. Three student-level predictor variables were included in analysis: FRL, ELL, and SPED. Each demographic variable was coded dichotomously, such that 1 indicated demographic membership and 0 indicated non-membership. All distribution and residual plots for outcome variables were analyzed to evaluate analytic assumptions. These included linearity, normality, homogeneity of error variances, and independence of errors. Data from each grade level

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[1] Models were also run with unadjusted scores and results did not differ.

sample were analyzed with scatter plots, histograms, quantile-quantile (Q-Q) plots, and probability-probability (P-P) plots to check the assumption of normality. Visual and statistical analysis of skew ($z < 1.96$) and kurtosis ($z < 1.96$) supported the assumptions of normality. There was no evidence of heteroscedasticity of errors.

A series of models were fit and the addition of each predictor was assessed through *F* tests of change. Predictors that significantly ($p \leq 0.01$ to control for family-wise error rates) increased the variance explained were included in the final model. Models are presented by grade in Table 6. The Huber-White sandwich estimator (Huber, 1967; White, 1982) was used to account for biased standard errors, thus addressing issues of clustering within the data. The author assessed collinearity by reviewing the variable inflation factor (VIF) to ensure values were in the acceptable (below 10). The intraclass correlation coefficient (ICC) was also calculated.

Results

Data were cleaned so that only students with fall and spring scores were included for analysis. Furthermore, students missing all demographic data were removed ($n = 8$). Thus, the total sample size was 649 students (98.8% retained). The stepwise models were created such that first a model was run with only adjusted spring score (Model 1). Main effects of demographic variables were added in Model 2, and interactions were added in Model 3 (when possible; this varied by grade due to sample size).

Model 1:

$$\hat{y} = \beta_0 + \beta_1 SSA$$

Model 2:

$$\hat{y} = \beta_0 + \beta_1 SSA + \beta_2 FRL + \beta_3 ELL + \beta_4 SPED + \beta_5 Race$$

Model 3:

$$\hat{y} = \beta_0 + \beta_1 SSA + \beta_2 FRL + \beta_3 ELL + \beta_4 SPED + \beta_5 Race +$$

$$\gamma_1 FRLxELL + \gamma_2 FRLxSPED + \gamma_3 FRLxRace +$$

$$\gamma_4 ELLxSPED + \gamma_5 ELLxRace + \gamma_6 SPEDxRace$$

Intraclass Correlations

The data were naturally clustered into classrooms and schools, so the intraclass correlation statistic was computed to determine the percentage of variance accounted for by teacher and school, respectively. Unconditional hierarchical linear models were run using teacher or school as level 2. The outcome variable was the summer change in letter sounds correct per minute in kindergarten and words read correct per minute in grades 1-5. The intraclass correlations ranged from 0-12%. There was 0% of variance accounted for by teacher in kindergarten, grade 3, and grade 5. In grade 1, the teacher accounted for 8% of variance. Teacher accounted for 6% of variance in grade 2, and 12% in grade 4.

School accounted for 0% of variance in Kindergarten and third grades. In first grade, school accounted for 9.5% of variance, compared to 1.4% in second grade, 10.4% in fourth grade, and 1.9% in fifth grade. In the combined grades model for grades 1-5, school accounted for approximately 4% of overall variance. The Huber-White sandwich estimator (Huber, 1967; White, 1982) was used to address these issues of clustering within the data.

Significance and Magnitude of Summer Learning Loss

To determine whether the effect of summer learning loss was statistically significant, paired sample *t*-tests were conducted by grade. The results are displayed in Table 7 and Figure 1. There was a significant effect of summer learning loss in the summer after grades K ($t = 3.90$, $p \leq .000$), 2 ($t = 8.67$, $p \leq .000$), 4 ($t = 11.88$, $p \leq .000$), and 5 ($t = 17.22$, $p \leq .000$). There was a non-significant effect of summer learning loss the summer after grade 3 ($t = 1.59$, $p \leq .12$), and a significant gain the summer after grade 1 ($t = -7.50$, $p \leq .000$).

Mean comparisons between spring and fall scores by grade can be found in Table 8. The average loss the summer after kindergarten was 5.3 letter sounds per minute. In the summer after first grade, the average student gained 14.8 words correct per minute, while in the summer after second grade there was an average loss of 9.5 WRCM. In the summer after third grade there was an average loss of 2.4 WRCM, and after fourth grade the average student lost 21.3 WRCM. The average student lost 18.6 WRCM the summer after fifth grade.

Meaningful change. In addition to statistical significance, the summer change was examined to determine whether or not it was meaningful. The author calculated effect sizes of the summer change, as well as reliable change indices by grade and for grades 1-5 combined. Cohen's *d* effect sizes and 95% confidence intervals are presented by grade and across grades 1-5 in Table 9. The effect size was small (i.e., < .20; Cohen, 1988) in third grade ($d = .17$). It was medium (e.g., .50-.70; Cohen, 1988) in grades K ($d = .52$), 1 ($d = -.82$; the average summer change was positive so the effect size is negative), and 2 ($d = .69$). The effect sizes for grades 4 ($d = 1.18$) and 5 ($d = 1.37$) fell between large and very large (e.g., .80-1.30; Cohen, 1988). The overall effect size for summer loss in grades 1-5 combined was .49, which is medium (Cohen, 1988).

In addition to effect sizes, the author used the formula for reliable change index (Jacobson, Follette, & Revenstorf, 1984) to determine the level of change at each grade that would be reliable given the standard error of measurement of CBM in that grade. To calculate the reliable change index, one divides the difference score by the standard error of measurement (Jacobson et al., 1984). If the difference is greater than the critical value of 1.96 (using a 5% significance level), the change is thought to be reliable (Kruyen, Emons, & Sitjsma, 2014). I reverse solved the equations using standard error of measurement values for kindergarten (Christ et al., 2014) and grades 1-5 (Christ & Silberglitt, 2007) to determine the minimum value required for a reliable change. I then calculated the percentage of students by grade that had a reliable change (see Table 10). In the summer after kindergarten, 30% of students experienced a reliable loss, while just 1% of students experienced a reliable loss after first grade. After second grade, 29% met criteria for a meaningful loss, and 16% did after third grade. More than half (53%) of students had a meaningful loss in WRCM after fourth grade, and 43% of students demonstrated a meaningful loss after fifth grade.

Influence of Demographic Characteristics on Summer Learning Loss

The section below presents the results of the multiple linear regression models run for each grade. Each grade-level model building process first added spring score, ELL status, FRL status, race, and SPED status, and then two-way interactions between main effect variables. A Bonferroni adjustment was made to control for family-wise error. The adjusted p value for significance was 0.01. It should be noted that due to linear relationships between variables, some interactions could not be calculated. The interactions of ELL and race/ethnicity and ELL and FRL could not be calculated in any grade because the variables were too closely related. The interaction of FRL and SPED could not be calculated in grade 1, nor could the interaction of SPED and race/ethnicity.

Influence of Demographic Characteristics on Summer Learning Loss

The author used a stepwise model-building procedure to examine the proportion of variance explained by demographic variables and determine which variables were significant predictors of summer change (see Table 6 for stepwise models). For each grade-level model, and for a combined grades model for grades 1-5, first a model was run with only adjusted spring score to control for the effect of students' initial score. Then, the main-effects of demographic variables (ELL, FRL, SPED, and race) were included. The third step was to examine interactions between main effects. Then, a final model was run with any significant interactions and/or main effects (see Table 6 for models by grade).

There was not a significant main effect of SPED, ELL, or FRL in any single grade. However, the effect of ELL was significant in the combined grades model. The effect of race was significant only in the kindergarten model.

The main effect of SSA was significant in the first, second, third, fourth, fifth, and combined grades models. However, the direction of the coefficient differed by grade. The coefficient was positive in the first and third grades and negative in the second, fourth, fifth, and combined grades models. The positive intercept indicated that in first and third grades, for every point gained in spring score, students were expected to show an advantage during the summer over the mean (e.g., more gain or less loss over the summer). In the second, fourth, fifth, and combined grades model, the negative coefficient for spring score indicated that for every point gained on the spring score, students were expected to lose a fraction of a WRCM more over the summer. For example, the combined grades 1-5 coefficient for spring score indicated that, for every one point gain on spring score, the model predicted an additional loss of .18 WRCM over the summer in the final model.

By examining the r^2 values for the models, one can see the proportion of variance in summer change accounted for by demographic variables. Overall, the change in r^2 between the model with only SSA and the model with the demographic variables (ELL, FRL, Race, and SPED) was small. In the combined grades 1-5 model, the r^2 increased from .29 to .31 when the four demographic variables were added, indicating that the addition of the variables accounted for an additional 2% of the variance in summer change above SSA alone. The increase in r^2 from model 1 (SSA only) to model 2 (demographic variables added) was 13% in kindergarten, 2% in first grade, 1% in second grade, 3% in third grade, 1% in fourth grade, and 2% in fifth grade. Thus, it appears that demographic variables had the largest impact in the summer after kindergarten.

In kindergarten, race was statistically significant, so a final model was run (model 3) with only SSA and race. The r^2 changed from 1% in model 1 to 14% in model 2, and decreased to 11% in model 3 once FRL, ELL, and SPED were removed. Thus, it appears that the combined effect of FRL, ELL, and SPED accounted for 3% of the variance in summer change after kindergarten, while race alone accounted for 10%. The coefficient for race in the final model was 8.09, indicating that students of color were expected to maintain 8.09 letter sounds more than White students. However, after removing other main effects, race/ethnicity was significant at $p \leq 0.05$ but not $p \leq 0.01$.

In the combined grades 1-5 model, there was a significant effect of ELL. Looking at the change in r^2 between models, it appears that ELL alone accounted for 2% of the variance in summer change. Students eligible for ELL services were predicted to lose 5.47 WRCM more over the summer than English proficient peers (see the coefficient for ELL in model 4 of the Grades 1-5 model in Table 6).

There was one significant interaction; the interaction between ELL and SPED was significant in second grade. Adding this interaction also caused SPED to be significant at $p \leq 0.05$. In the summer after second grade, students eligible for ELL were predicted to lose 2.97 WRCM more than English proficient peers, and students eligible for SPED were predicted to lose 5.17 WRCM more than general education students. However, students eligible for both ELL and SPED services were predicted to maintain 3.72 WRCM more than students not eligible for either ELL nor SPED. The advantage for ELL and SPED students over ELL only was 6.69 WRCM, while the advantage for ELL and SPED students over SPED only was 8.89 WRCM.

Discussion

The purpose of this study was to extend upon previous research on summer learning loss (e.g., Cooper et al., 1996; Baker & Christ, 2015). This study followed the recommendations of previous research by utilizing a research design that fully accounted for intervening instructional days (Cooper et al., 1996). The first aim was to determine the significance and magnitude of summer learning loss in reading in primary grades. The second aim was to focus on demographic variables and differences in initial (pre-summer) levels of achievement and how these impact summer change in reading.

Adjusted spring score on the CBM-R task was significant in grades 1, 2, 3, 4, and 5; but the direction of the coefficient varied by grade. Overall, the addition of demographic variables and interactions accounted for a small percentage of the variance in summer change. The percentage of variance explained by main effects of demographic variables ranged from 1% to 13%. Each research question will be discussed below.

Significance and Magnitude of Summer Learning Loss

There was a significant effect of summer learning loss in reading in grades K, 2, 4, and 5. The effect sizes ranged from small in third grade (d = .17) to medium in grades K (d = .52), 2 (d = .62), and 1 (d = -.82), to large in grades 4 (d = 1.18) and 5 (d = 1.37). Similarly, the percentage of students that experienced a reliable loss ranged from 1% after grade 1 to 53% after grade 4. While just 16% of students met criteria for a reliable loss after third grade, more than one-fourth of the students experienced a reliable loss after kindergarten (30%) and grade 2 (29%), and 43% experienced reliable loss after grade 5.

Using estimated CBM-R weekly growth rates (Deno, Fuchs, Marston, & Shin, 2001; see Table 11) for grades 1-5, one can estimate the magnitude and implication of summer learning loss or gain relative to instructional weeks during the academic year. First graders were estimated to gain approximately 1.8 WRCM (Deno et al., 2001). In the summer after first grade, the average student gained 14.8 WRCM, which was equivalent to an instructional gain of 8.2 weeks. The Deno et al. (2001) weekly growth rate for second grade was 1.66 WRCM, and in the summer after second grade, there was an average loss of 9.5 WRCM. This was an instructional loss of 5.7 weeks. The estimated growth rate for third grade was 1.18 WRCM (Deno et al., 2001). In the summer after third grade there was an average loss of 2.4 WRCM, which was an instructional loss of two weeks. The fourth grade weekly growth was 1.01 WRCM (Deno et al., 2001) and after fourth grade the average student lost 21.3 WRCM. That equated to an instructional loss of 21.1 weeks. Finally, the fifth grade growth rate estimate was .58 WRCM (Deno et al., 2001), and the average student lost 18.6 WRCM the summer after fifth grade. That was an instructional loss of 32.1 weeks. Using publisher estimates (Christ et al., 2016) of growth for kindergarten, the average summer loss of 5.5 LS was equal to 5.4 weeks of instructional growth. See Table 11 for the summer change interpreted as weekly growth by two estimates, one from previous research (Deno et al., 2001) and one from the publisher of the CBM-R tools (FAST; Christ et. al., 2016). Overall, the publisher growth rates by grade (Christ et al., 2016) matched the growth estimates from previous research (Deno et al., 2001) quite well with the exception of fifth grade, where the loss was smaller using publisher norms: 20.7 weeks (Christ et al., 2016) compared to 32.1 weeks (Deno et al., 2001).

The summer change by grade using grade-level growth estimates from research (Deno et al., 2001) ranged from a gain of 8.2 instructional weeks the summer after first grade to a loss of 32 instructional weeks the summer after fifth grade. Using publisher norms (Christ et al., 2016), the instructional equivalent of summer change ranged from a growth of 10.7 weeks after first grade to a loss of 21.3 weeks the summer after fourth grade. This summer loss has a twofold effect; first, students lose previous instructional gains in fluency, and second, their new teachers must spend time recouping the lost skills in the fall of the next school year. A better understanding of which students are most susceptible to high levels of summer learning loss in reading may allow schools to target these students with supported services to prevent this double effect of loss and recuperation.

Influence of Demographics on Summer Learning Loss

The effects of each demographic variable (SSA, ELL, SPED, FRL, race/ethnicity, and grade) are presented in the following sections.

Spring Score. Three of the 15 studies in the literature review included initial achievement level (viz., Downey et al., 2004; Rambo-Hernandez & McCoach, 2015; Lawrence et al., 2014). Two studies found that higher achieving students exhibited greater summer growth (viz., Downey et al., 2004; Rambo-Hernandez & McCoach, 2015). The third study found no effect of initial achievement on vocabulary in middle school (Lawrence et al., 2014).

In the present study, SSA was significant in the final models for grades 1, 2, 3, 4, and 5. It was also significant in the model for grades 1-5 combined. However, higher SSA predicted a more positive summer change (i.e., less summer loss) in grades 1 and 3, and predicted more loss in grades 2, 4, 5, and the combined grades model. Interestingly, the two grades in which SSA was associated with a more positive summer change (grades

1 and 3) were the grades without a significant effect of summer learning loss in reading. There was a significant gain in grade 1 on average, and a trend effect of summer loss in third grade. The present study supports the findings of previous research (viz., Downey et al., 2004; Rambo-Hernandez & McCoach, 2015) that found that initially higher achieving students exhibited greater loss in three grades: second, fourth, and fifth.

ELL. Three of the 15 studies in the literature review included language in the analyses (viz., Lawrence, 2012; LoGerfo et al., 2006; Sandberg Patton & Reschly, 2013). One study reported greater vocabulary loss for students from non-English speaking homes (Lawrence, 2012), one study indicated there was a slight advantage for students from non-English speaking homes (LoGerfo et al., 2006), and a third found no effect of ELL (Sandberg Patton & Reschly, 2013).

In the present study, the effect of ELL was significant only in the combined grades 1-5 model. In the combined grades model, students eligible for ELL were predicted to lose 5.47 WRCM more than English proficient peers. The effect of ELL was not significant in any of the individual grade-level models. This may have been due to small sample size (20% of students in grades 1-5 were ELL), and overlap with other variables. For instance, 98% of ELL students were also non-white.

There was a significant interaction of ELL and SPED in the summer after second grade. While ELL students were estimated to lose approximately three WRCM more than non-ELL peers, students who were both ELL and SPED were predicted to have a 3.72 point advantage over students who were neither ELL nor SPED. It is possible that the combination of both ELL and SPED services provide additional services to students that bolster support, especially after second grade.

SPED. As discussed in the introduction, only three of the 15 studies in the review of studies on summer learning loss in reading in the past 20 years examined summer loss in students eligible for SPED (viz., Allinder & Eicher, 1994; Lawrence et al., 2014; Sandberg Patton & Reschly, 2013). One study found an average loss in students eligible for SPED in grades 2-5 (Allinder & Eicher, 1994). Another found no effect of summer learning loss in vocabulary for students in grades 6-8 (Lawrence et al., 2014). The third found an effect of SPED after grade 2, but not in grades 3-5 (Sandberg, Patton & Reschly, 2013). However, students eligible for SPED scored lower in the fall and spring than general education students in grades 3, 4, and 5 (Sandberg Patton & Reschly, 2013). In the present study, the main effect of SPED was significant only in grade 4. Furthermore, the coefficient for SPED was negative, indicating that students eligible for SPED experienced greater loss than general education students, only in grades 3 and 4.

FRL. Nine of the 15 studies included SES (viz., Alexander et al., 2001; Burkam et al., 2004; Downey et al., 2004; Henry et al., 2003; Lawrence, 2012; LoGerfo et al., 2006; McCoach et al., 2006; Ready, 2010; Sandberg Patton & Reschly, 2013), and all but one study (Lawrence, 2012) found a negative effect of SES on summer loss in reading. Although they did not include a measure of SES, Helf et al. (2008) concluded that kindergarten and first grade students from disadvantaged backgrounds did not show a drop in early literacy skills over the summer. In the present study, FRL had a negative impact on summer learning loss in reading in only four of the six grades studied (grades

K, 2, 4, and 5). It did not have a negative effect the summer after third or fifth grade. However, more than 60% of the overall sample was eligible for FRL. Furthermore, FRL may not be the best measure of socioeconomic status (Harwell & LeBeau, 2010). Eligibility for the National School Lunch Program is a poor measure of a family's economic resources as some students can be eligible even if they do not meet the income requirements and the income requirements do not take into account cost of living (Harwell & LeBeau, 2010). The high proportion of students eligible for FRL and the nature of FRL as a proxy for SES may account for the differences in the results of the present study from those included in the review.

Race/ethnicity. There was a significant effect of race in kindergarten only. However, the effect of race was significant at the $p \leq 0.01$ level in Model 2, was not significant in Model 3 once interactions were added, but when interactions were removed, race was significant only at the $p \leq 0.05$ level. Thus, it appears that controlling for the effects of ELL, FRL, and SPED allowed for a better estimate of race in the kindergarten model. In the final model, students of color were predicted to maintain eight LS more than White students.

Grade. Cooper et al. (1996) reported that the effect of summer learning loss increased as grade increased. Furthermore, they stated that early grades showed positive growth over the summer (Cooper et al., 1996). The results of the present study support previous research to some extent. In the combined grades model for grades 1-5, there was a significant effect of grade such that the effect of summer learning loss in reading increased as grade increased. Furthermore, there was a significant gain in the summer after first grade.

Two previous studies found no effect of summer learning loss after first grade (viz., Alexander et al., 2001; Helf et al., 2008). In fact, Helf et al. (2008) reported a gain of approximately five WRCM for not-at-risk students and seven to 15 WRCM for at-risk students between first and second grade. It is possible that the third grade sample size ($n = 90$), which was smaller than grades 2, 4, or 5, contributed to the lack of significance in the summer change in the present study. Still, only three of the five studies in the literature review (60%) reported a loss in third grade (viz., Sandberg Patton & Reschly, 2013; Allinder & Eicher, 1994; Atteberry & McEachin, 2015). The results of the present study, in summary, somewhat support the Cooper et al. (1996) conclusion that loss increases as grade increases based on the large losses in fourth and fifth grades – especially when converted to weeks of instructional growth using the Deno et al. (2001) rates. However, the present study provides evidence of a loss in letter sound fluency after kindergarten, in contrast to some previous research. Future research may further illuminate patterns of loss by grade level.

Implications

The effects of summer learning loss in reading have implications for both general and special education students, and research on this topic has relevance for both public policy and future research. The results of the present study have implications, therefore, in practice, policy, and research. These implications are discussed below.

Practice. The methods and procedures used in the present study offer one way schools may use their extant data to learn more about summer learning loss in their student population. If students are screened as close to the end and as close to the beginning of the school year as possible, intervening instructional time is minimized and summer change can be calculated more accurately. Thus, schools can determine the degree to which instructional gains are being lost over the summer. This analysis may be performed with reading data, but could also be applied to math, socio-emotional, or behavior screening data. Furthermore, schools and districts may be able to determine whether groups of students (e.g., students eligible for FRL, SPED, or ELL services) are more likely to exhibit a loss than other students. This knowledge would allow schools and districts to target students most susceptible to summer learning loss.

As future research emerges to suggest which students are most at risk for summer learning loss, educators may develop screening measures and implement a Response to Intervention (RTI) framework during the summer. RTI is a service delivery framework that focuses on providing quality instruction and intervention to all students, and using student progress to make instructional decisions (Batsche et al., 2005). Summer services may be considered supplemental services and be provided to students most at-risk for summer learning loss. According to previous research, Tier II interventions should be provided in addition to core instruction for 20-40 minutes, three to five times per week (Gersten et al., 2009) for 8 to 16 weeks (Burns et al., 2006). The RTI model may be a way for schools to promote student achievement and reduce summer learning loss by targeting research-based services to student needs.

Policy. The present study demonstrated that summer learning loss in reading varied by grade and some demographic variables. The mixed results in the Cooper et al. (1996) meta-analysis and in the studies published in the last 20 years on summer learning loss in reading, along with the results of the present study, indicate how difficult it can be to predict summer learning loss. However, this is what school personnel are asked to do when making extended school year decisions. In fact, this determination can be made using expert opinion (Jacob et al., 2011). Policy should be revised to provide more specific guidelines for extended school year decision-making.

Research. The present study adhered to cautions set forth in previous research (e.g., Cooper et al., 1996) to control for intervening instructional time, and found a significant effect of summer learning loss in four of the six grades studied. Furthermore, measures of meaningful change, such as effect sizes and reliable change, were used in addition to significance to ease interpretation and make the study findings more comparable to future research. A review of summer learning loss in reading literature yielded just 15 studies in the past 20 years, and only 53% found an average effect of loss. Furthermore, previous research in this area is difficult to compare due to differing methods and outcome variables. Despite the strengths of the present study, there are unanswered questions about the effects of demographic variables on summer learning loss. There is a need for methodologically sound research in summer learning loss that builds upon the present study to determine trends in summer loss by demographic variables, grade, and initial achievement. Future research should extend the generalizability of findings and have implications for practice and policy.

Strengths and Limitations

The present study heeded warnings from Cooper et al. (1996) and adjusted for intervening instructional time by testing students in the last two weeks of the spring and the first two weeks of the fall. This allowed for investigation of summer learning loss by grade and by multiple demographic variables as well as initial achievement. It also included various demographic variables and examined summer learning loss in reading by SES, ELL, FRL, race/ethnicity, SSA, and grade. Furthermore, to ensure fidelity of administration and accuracy of scores all data collectors received in-person training as well as online certification, all data collectors were observed in person using a fidelity checklist, and inter-scorer agreement was calculated for 20% of the final sample.

This study has its own limitations. Due to the number of data points per student and the purpose of the study, hierarchical linear modeling could not be used. Although the Huber-White Sandwich (Huber, 1967; White, 1982) accounted for some of the clustering in the data, there may have been some unaccounted variance based on school or teacher influence. The data used were only from one district, and only three schools. The results may not be generalizable to other states or regions.

In spite of its limitations, the present study is an important step in the research of summer learning loss. As previously discussed, a review of literature from the past 20 years found only 15 studies of summer learning loss in reading. The considerations presented for future practice, policy, and research provide opportunities for the field to promote the achievement of all students.

Final Statements

The present study minimized intervening instructional time to better estimate the significance and magnitude of summer learning loss in reading. There was a significant effect of summer learning loss in reading the summers after grades K, 2, 4, and 5. The losses equated to medium to large effect sizes (d = .52 – 1.37), and the proportion of students that exhibited a reliable loss ranged from 29% to 53% in those grades.

It is not enough to simply observe that there is or is not loss. It is better to know the nuances of loss and gain. For example, the present study demonstrated that while ELL students exhibited significantly more summer learning loss in reading fluency when grades 1-5 were combined, overall demographic variables accounted for a small proportion of variance in summer change. Therefore, future research must extend the present study and examine other factors that may make students more or less susceptible to summer loss, such as summer activities.

CHAPTER 3: EFFECTS OF SUMMER ACTIVITY ON SUMMER LOSS

Research demonstrating the detrimental effect of summer learning loss on reading achievement (e.g., Heyns, 1978; Cooper et al., 1996) has led researchers to question how summer can be used for schooling and intervention, and which summer activities may decrease these detrimental effects. The majority of research has found that summer learning loss in reading varies by SES, with students from low-SES families more likely to exhibit a loss of reading achievement over the summer (Alexander et al., 2001; Burkam et al., 2004; Downey et al., 2004; Henry et al., 2003; LoGerfo et al., 2006; McCoach et al., 2006; Ready, 2010; Sandberg Patton & Reschly, 2013). There is also evidence that low-SES students are less likely to visit libraries over the summer (U.S. Department of Education, 2015) but are more likely to benefit from summer interventions (Kim & Quinn, 2013). One important area that has received little attention is the effect of summer activities at home, particularly those beyond formal intervention or summer school. Research on how summer activities at home, such as reading or visiting the library, affect summer learning loss in reading may inform both educational service delivery and policy with the aim to close achievement gaps in reading.

Gaps in reading achievement persist by race, SES, and disability status. This gap is evident in the National Assessment of Educational Progress (NAEP) reading scores, which are scaled on an item response theory (IRT) scale from 0-500 (U.S. Department of Education, 2015). On average, Black fourth grade students scored 26 points below White students in 2015, a gap that has changed little since the 32-point difference in 1992 (U.S. Department of Education, 2015). Students who were eligible for FRL lagged 28 points behind ineligible peers (U.S. Department of Education, 2015). Similarly, students who were identified as having one or more disability scored 187 on average, while students without disabilities scored 228 – a difference of 41 points (U.S. Department of Education, 2015). Research indicates that summer learning loss may contribute to and exacerbate achievement gaps, since nearly every achievement gap grows during the summer and decreases over the school year (Downey et al., 2004). Thus, research on the effects of summer activity and summer learning loss needs to be investigated, especially for students from low-SES backgrounds, students with disabilities, and minority students.

Summer Activity

There is evidence that summer activity varies by SES. The National Center for Education Statistics (NCES) used data from the Early Childhood Longitudinal Study, Kindergarten class of 1998-1999 (ECLS-K) to examine summer activity over the summer after kindergarten, disaggregating high, middle, and low-SES groups. Results indicated that low-SES children were least likely to participate in the nine activities examined, which included visiting the library, bookstore, state or national parks, art or other museums, zoos or petting farms, historic sites, concerts or plays, camp, or vacation (U.S. Department of Education, 2004). Approximately 46% of low-SES children visited a library over the summer, compared to 66% of middle-SES and 80% of high-SES children. Furthermore, low-SES children that visited the library went less often (on average, four times per summer) than middle or high-SES children (seven times per summer on average; U.S. Department of Education, 2004). In addition, low-SES parents were less likely to report having a neighborhood library (64%) than middle-SES (81%) or high-SES (91%) parents (U.S. Department of Education, 2004). Finally, even when high-SES children did not have a neighborhood library, they were still more likely to visit the library (72% of high-SES children without a neighborhood library visited) than low-SES children without a neighborhood library (31% visited), suggesting that low-SES children were affected more by lack of a neighborhood library than their high-SES peers (U.S. Department of Education, 2004).

Numerous published studies evaluated the effects of summer interventions both at school and at home (see Kim & Quinn, 2013 for a review of 41 studies). Researchers have also investigated lower-resource interventions, such as the provision of reading materials over the summer. Kim (2006) provided fourth grade students with eight books to read over summer vacation, and reported that the effects on fall reading were greatest for Black students (*ES* = .22), followed by Latino students (*ES* = .14) and students who owned fewer than 50 children's books (*ES* = .13).

Overall, regardless of SES, the average effect size of summer interventions was found to be relatively small (*d* = .10; Cohen, 1988) based on 41 independent samples (Kim & Quinn, 2013). On average, low-SES children have been found to benefit more than higher SES children from summer reading intervention (Kim & Quinn, 2013). However, the effect size varied by reading sub-skill. For example, the effect of intervention was larger for reading comprehension (*d* = .23) compared to the very small effect on vocabulary (*d* = .04; Kim & Quinn, 2013). In contrast to previous research demonstrating larger effects of summer school for middle-SES students, defined as the group of students between low-SES and high-SES groups (Cooper et al., 2000), Kim and

Quinn (2013) reported statistically greater effects for low-SES children. The effect of summer intervention on reading comprehension total outcome was larger for low-SES (*d* = .20) than mixed-SES (defined as samples where fewer than 50% of participants were FRL eligible but proportions of middle- and high-SES participants were not available; *d* = .00) samples (Kim & Quinn, 2013). Similar results were found for reading comprehension only outcomes, which were greater for low-SES (*d* = .33) than mixed-SES (*d* = -.05) samples.

Despite a wealth of research on summer school and summer interventions, there is little published research on the effects of other summer activities on summer learning loss. A systematic literature review completed by the author yielded just 15 reports and studies on summer learning loss since 1994. Only three of the 15 reviewed studies (20%) analyzed the effects of summer activity (viz., Burkam et al., 2004; Lawrence, 2009; Lawrence, 2012). In the summer after kindergarten, participation in summer literacy activities was a small but significant predictor of summer change (*ES* = .02; Burkam et al., 2004). The summer literacy activities variable was a composite of parent-reported summer activity such as reading and writing, attending story time, and visiting libraries and bookstores. While the effect size of summer activities was small, it did explain unique variance in the model above and beyond the effects of SES (Burkam et al., 2004). Still, the authors cautioned that summer activities had little influence on the summer learning trajectory in literacy (Burkam et al., 2004). There was a significant effect of number of library visits, number of bookstore visits, and the overall composite of summer literacy activities at home (Burkam et al., 2004). Low-SES parents reported that they read books over the summer slightly less often than high-SES parents, and a similar pattern emerged for library and bookstore visits. The low-SES children experienced fewer composite literacy activities over the summer (0.3 *SD* below the mean) while high-SES children experienced more (0.2 *SD* above the mean; Burkam et al., 2004).

The other two studies that examined the effects of summer activity on summer learning loss in reading were studies of vocabulary loss in grades 6-7. In middle school, on average, student-reported time spent reading was not a significant predictor of summer vocabulary loss (viz., Lawrence 2009; Lawrence, 2012). However, there was a significant interaction effect of expository and narrative reading for students who scored in the top 50% on a cloze reading task, which required participants to select the best word to complete the sentence (Lawrence, 2009). The authors suggested that expository and narrative reading only benefits students with advanced abilities as measured by the cloze reading task (Lawrence, 2009).

The impact of summer activity on summer learning loss is an intriguing and promising topic for future research, especially after controlling for the potentially confounding effects of SES. There is a need for research to further explore the impact of summer activities, including but not exclusively summer literacy activities, on summer learning loss in reading. This research has the potential to inform public policy and resource allocations at the level of a school, district, or state.

Purpose

The purpose of this study was to estimate the influences of various summer activities, such as home literacy activities and summer program attendance, on summer learning loss. This study extends previous findings with a refined research design to fully account for intervening instructional days. The study also includes analyses to explore the influence of summer activities after accounting for influential demographic characteristics determined by the results of study one, such as grade level and SES. The specific research questions were: a) to what extent do summer activities affect summer learning loss in reading; and b) to what extent is there an effect of summer activities on summer learning loss in reading after controlling for potentially influential demographic characteristics? It was expected that higher levels of summer literacy activities would correlate with less summer learning loss, and that students that attended school programs over the summer would be less likely to experience a loss of reading achievement over the summer.

Methods

Participants and Setting (Same as Study 1)

The participants in this study were 649 students in grades kindergarten (n = 56), first (n = 83), second (n = 160), third (n = 90), fourth (n = 101) and fifth (n = 159). The 657 students (84.6%) who were tested in the spring were re-tested in the fall (15.4% attrition). Note that students are referred to by their grade in spring 2016. All students attended one of three schools (37 classrooms in spring 2016) in a suburban school district in the Midwest (see Table 12 for demographics by school and district). Demographic information for the participant sample is included in Table 13. Overall, the sample was 49.6% male, and the racial/ethnic composition was: 33% White, 30.5% Asian, 20% Black, 14.8% Hispanic, and 1.7% Hawaiian or Pacific Islander. Of the overall sample, 62.9% were eligible for FRL, 21.9% were designated as ELL, and 10.6% were receiving SPED services. Each student was tested once in the spring of the 2015-16 school year and once in the fall of the 2016-17 school year. All testing occasions occurred during the final nine days of instruction in the spring, and the first nine days of instruction in the fall.

Parents of students in the study schools were given the opportunity to opt out of the study. Each school determined the sampling methodology. All general education (i.e., not a separate resource room or dual language program) students at school one were tested (participation rate of grades K-5 = 60.6%). At school two, teachers were allowed to opt in for the study (participation rate = 30.2%). At school three, all students in general education were tested (participation rate = 42.3%). Two make-up testing days were added to the end of the testing interval to test students that were absent on previous testing days.

Measures (Same as Study 1)

FastBridge Learning curriculum-based measures in oral reading (CBM-R) and letter sounds (LS) were used (Christ et al., 2014). CBM-R was a published, standardized, individually administered, norm- and criterion-referenced measure of oral reading fluency (ORF). The administrator read standardized directions that guided the student to read aloud for one minute from each of three successive grade-level passages. The administrator noted any errors. Cloud-based software timed the administration duration and auto-calculated the number of words read correctly per minute (WRCM) and total accuracy. WRCM was used as the outcome variable for analysis. The LS task was similar, but students read letter sounds in place of words. The publisher indicated that LS was the most similar task to CBM-R and was the best approximation of a general outcome measure (GOM; Fuchs & Deno, 1991) for reading achievement in kindergarten (T. J. Christ, personal communication, July 8, 2016). Consistent with the CBM-R procedures, each student identified letter sounds for one minute on each of three successive forms. LS read correctly per minute (LSCM) and total accuracy were calculated. LSCM was used as the outcome variable for analysis. The median score for each student was used for analysis.

FastBridge Learning CBM-R demonstrated high test-retest reliability, ranging from .88 to .95 from fall to winter (Christ et al., 2014). The predictive validity coefficients of CBM-R with the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) Next ranged from .74 to .82 (mean time lapse of approximately 35 weeks), and the predictive validity coefficients of CBM-R with AIMSweb reading CBM ranged from .95 to .97 (time lapse of approximately 19 weeks; Christ et al., 2014). Concurrent validity coefficients for CBM-R with the Test of Silent Reading Efficiency and Comprehension (TOSREC) in grades 1-5 ranged from .79 to .86, and concurrent validity coefficients for CBM-R and DIBELS NEXT in grades 1-5 ranged from .92 to .96. High concurrent validity coefficients were also found between CBM-R and AIMSweb (.95-.97) in grades 1-5. Validity coefficients were similar across grades.

Kindergarten participants completed FastBridge Learning Early Reading LS probes (Christ et al., 2014). The test-retest validity coefficients for FastBridge Learning LS ranged from 0.35 from fall to spring screening to 0.92 over a period of two to three weeks (Christ et al., 2014). LS also demonstrated high internal consistency, with a coefficient alpha of .93 for 10 items and .98 for both 30 and 50 items (Christ et al., 2014).

The concurrent validity of LS to the Group Reading Assessment and Diagnostic Evaluation (GRADE) was .53 for fall scores (Christ et al., 2014). The predictive validity for LS and GRADE composite score for winter to spring prediction was .63 (Christ et al., 2014).

Additional measure for study two. A short survey was administered to all participants during fall data collection. The purpose of the survey was to obtain information about the student's summer literacy activities. The survey was adapted with permission from that used by Borman, Benson, and Overman (2005). Modifications were made to shorten the survey to eight items: the number of items that the school district agreed upon for the student survey. Modifications were also made to make Borman and colleagues' parent survey more appropriate for students in grades 1-5. The survey is included in Appendix B.

Inter-scorer Agreement

Inter-scorer agreement was calculated for 20% of the final sample (n = 132). The author listened to audio recordings and independently scored those administrations. She marked words or letter sounds as correct or incorrect, and compared that score to that of the field-based data collector for the median probe for each participant. Point by point agreement was calculated for each probe by dividing the number of agreements by the total words read (i.e., agreements plus disagreements) and multiplying by 100. The average median score on inter-scorer agreement was 98.66% (SD = 1.49).

Fidelity

Procedural fidelity was assessed with the *Observational Rating of Administrator Accuracy* (ORAA; Christ et al., 2013; see Appendix A) checklist. The author observed all data collectors and noted whether they adhered to the standardized data collection procedures by marking on the checklist if each step was followed. Examples of checklist items include whether the instructions were read, the timer was started at the appropriate time, and the last word was correctly marked. The ORAAs were used for CBM-R and LS observations. The average median score on the fidelity checklist was 98.86 (*SD* = 3.07).

Summer Activities

There were two sources for summer activities data: the results of the student survey and district data on summer school. Student survey results provided information regarding the student's literacy-related activities over the summer, such as visiting the library or reading at home. The district provided data that indicated which students attended one or both of two district summer school programs. These programs are described in the variables section below.

Procedure

Although the schools included in the study administered CBM-R three times per year, additional data were collected. To minimize the potential effect of instructional time on summer measurement, data were collected in the final two weeks of the 2015-16 academic year and the first two weeks of the 2016-17 academic year. All students were assessed within seven school days in the spring, and seven school days in the fall.

Schools were allowed to opt in for the additional data collection. Parents were also given the opportunity to opt out of their child's participation.

School psychology graduate students and trained data collectors employed by FastBridge Learning collected all data. Data collectors completed both in-person and online training. The online training required the completion of three practice CBM-R ORF passages with a minimum of 95% accuracy. The author observed data collectors using a fidelity checklist to ensure standardized directions were given and all procedures were completed accurately. Each data collector was observed using the ORAA. The average median score on the fidelity checklist was 98.86 (*SD* = 3.07). Inter-scorer agreement was calculated using audio recordings for 20% of students in the final sample. The average median score on inter-scorer agreement was 98.66% (*SD* = 1.49).

Variables

SSA. Each individual student's pre-score, or adjusted spring 2016 score (SSA) in WRCM, was used as a predictor variable in the regression.

FRL. FRL status was a dichotomous variable that indicated eligibility. The school district provided data on which students were eligible (1) and which were ineligible (0) for free or reduced price lunch. FRL was used in this study as a proxy for SES.

SPED. SPED status was a dichotomous variable that indicated eligibility. The school district provided data on which students were eligible (1) and which were ineligible (0) for special education services.

ELL. ELL status was a dichotomous variable that indicated eligibility. The school district provided data on which students were eligible (1) and which were ineligible (0) for English language services.

Race/Ethnicity. Race/ethnicity information was provided by the district and included in analysis. It was coded as a dichotomous variable, with values White (0) and non-White (1).

Interactions. Two-way interaction terms were included to identify any significant interactions between two variables and summer change.

SLS. The sum of student responses on the seven items on the Summer Literacy Survey (SLS; see Appendix B) was used as a scaled score representative of the student's home-based summer literacy activities.

FC. The school district provided information regarding student participation in school-sponsored summer activities including a non-academic summer program. The program was called Friendship Connection (FC). Participation in the summer program was entered as an individual dichotomous variable that indicated whether the student participated (1) or did not participate (0). Attendance information was not available.

The Friendship Connection program was a fee-based childcare program. It was open from 6:30am – 6:00pm during the summer. It included 30 minutes of reading time in the morning and 30 minutes of literacy in the afternoon, but mostly gave students the opportunity to pursue interests in projects, play outside, and go on field trips. Parents could decide to send their children for the full day, just the morning, or just the afternoon. See Table 14 for FC participation rates.

TOPS. The school district provided information regarding student participation in a school-sponsored academic summer program called TOPS. Participation in the summer program was entered as an individual dichotomous variable that indicated whether the student participated (1) or did not participate (0). Attendance information on the program was not available. See Table 14 for TOPS participation rates.

The TOPS program was a targeted summer program. The district identified students below the 50th percentile on a district test and then allowed classroom teachers to nominate students to be invited to participate. The program lasted four hours a day for five weeks from mid-June to late July. Each day, students received instruction in math, reading/English, and writing, as well as specialist classes such as Physical Education. A set curriculum was used for writing, and math strategies were provided for teachers, but based on district information about the program, there was not a set curriculum or strategies provided for reading instruction.

Analysis

Linear multiple regression models were fit for each grade level using *R: A Language and Environment for Statistical Computing software* (R Core Team, 2014). The outcome variable was the adjusted[2] change from spring to fall score on CBM-R and LS. Although, historically, some have questioned the use of change scores (e.g., Cronbach & Furby, 1970), others have more recently minimized concerns (e.g., Willett, 1988; Oakes & Feldman, 2001). Predictor variables included were: pre-score, FRL (i.e., eligible or ineligible), other demographic variable(s) identified in study one, and summer

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[2] Models were also run with unadjusted scores and results did not differ.

reading activities. Summer reading activities were included in the model as a continuous variable, indicating the extent to which the student participated in the activities as reported by the student on the survey administered at the time of fall data collection. Summer school or summer program attendance was also included in the model. Distribution and residual plots of the scores determined whether the assumptions required for estimation and inference were met: linearity, normality, independence of the errors, and constant variance.

Multiple regression models were run to determine the most parsimonious model that explained the largest proportion of the variance in the outcome variable. The base model was the final model from study one. Summer predictors were then added, and the author assessed variance explained through *F* tests of change. Standard errors were corrected using the Huber-White sandwich estimator (Huber, 1967; White, 1982) to account for biased standard errors. This accounts for the fact that the observations, all from the same district but clustered in classrooms, do not fully meet the assumption of independence. In other words, the estimator partially controls for bias on the standard errors from the effects of clustering. Because there may be issues with collinearity between SES and summer activities, the variance inflation factor (VIF) was examined to determine if correlation between variables were at acceptable levels (i.e., ≤ 10). The ICC was also calculated.

Results

Data were cleaned so that only students with fall and spring scores were included for analysis. Furthermore, students missing all demographic data were removed ($n = 8$).

Thus, the total sample size was 649 students (98.8% retained). Significant variables and interactions ($p \leq 0.01$) from study 1 were included in each grade-level model. If an interaction effect was significant, both main effects were included; however, interactions were only created between summer variables and significant main effect variables from study 1. This procedure was used to produce parsimonious models (Fox, 2008) without extraneous predictors that account for little to no variance in the outcome. However, interactions were created between each variable and FRL, because previous research indicated that SES had an impact on summer activity (e.g., U.S. Department of Education, 2004). Although FRL was not significant in any grade-level models in study 1, previous research found SES to impact summer activities and the degree to which students benefitted from summer interventions. Even if FRL did not account for a significant portion of the variance in study 1, previous research indicated that it might interact with summer variables, so it was included to examine the interactions.

Stepwise model-building procedures were as follows: Model 1 included SSA and any significant predictors from study one. Model 2 added in main effects of summer variables, and Model 3 added in FRL and interactions between FRL and summer variables. Model 4 was a final model with only significant predictors. An example of the stepwise model-building procedure, where no significant predictors were maintained from study one, is provided below:

Model 1:

$$\hat{y} = \beta_0 + \beta_1 SSA$$

Model 2:

$$\hat{y} = \beta_0 + \beta_1 SSA + \beta_2 FC + \beta_3 TOPS + \beta_4 \text{SLS}$$

Model 3:

$$\hat{y} = \beta_0 + \beta_1 SSA + \beta_2 FC + \beta_3 TOPS + \beta_4 \text{SLS} + \beta_5 FRL + \gamma_1 FRLxSLS + \gamma_2 FRLxFC + \gamma_3 FRLxTOPS$$

Summer Activities Survey Analysis

A summer activities survey was developed for this study, which is described in the Methods. Coefficient alpha ranged from .59 in third grade to .73 in kindergarten and second grades (see Table 15 for coefficient alpha values). Analysis of coefficient alpha data supported the deletion of one survey item: camp. Removing the item, which asked whether the student had attended camp over the summer, increased the coefficient alpha in all grades, so the item was removed for all grades.

Test-retest reliability was calculated for 30 students per grade in grades K, 2, and 5. The test-retest reliability was .64 for kindergarten, .73 for second grade, and .90 for fifth grade. Overall, the test-retest reliability of the survey used in grades 1-5 (calculated by combining the reliability values in second and fifth grade) was .82. The survey was administered twice, approximately 10 days apart. Split-half reliability values for the survey, adjusted with the Spearman-Brown formula, ranged from .64 in fourth grade to .79 in kindergarten (see Table 15 for adjusted and unadjusted split-half reliability values). The sums of survey scores were reviewed to determine if they were well approximated by a continuous variable. See Tables 16 and 17 for grade-level means by SLS item.

Effects of Summer Activities on Summer Learning Loss

Overall, summer variables (SLS, FC, and TOPS; see Table 14 for participation rates) had little impact on summer learning loss. In some individual grade models, as well as in the model for grades 1-5, the addition of summer variables decreased the proportion of variance explained (see Table 18). In examining the coefficients in Model 3 by grade, we see that SLS was positive in grades K, 1, 2, 3, 5, and combined grades 1-5. This indicated that in those grades, an increase in SLS was associated with a more positive summer trajectory, or less loss. SLS was negative only in grade 4. TOPS was negative in grades K, 1, 2, and 4 and positive in grades 3, 5, and combined 1-5. FC was negative in grades K, 1, 5, and combined 1-5. Thus, the impact of the two summer programs was positive in approximately half of the grades, though there were some differences in which program had a positive impact by grade.

At the $p \leq 0.01$ level, there was a significant main effect of summer activity in grade 3 only. In the summer after third grade, there was a significant effect of SLS, such that a one-point increase in SLS was predicted to lead to an additional 1.29 WRCM maintained (see Table 18). There was also a significant effect of FC in model 3 for third grade, but it was no longer significant in Model 4 once interactions were removed.

The effects of TOPS and FRL x TOPS in fifth grade were significant at the $p \leq 0.05$ level but not $p \leq 0.01$. In Model 3, we see that fifth grade students that attended TOPS were predicted to maintain 6 WRCM more than peers who did not participate. The coefficient for the FRL x TOPS interaction for Model 3 in fifth grade was -10.67. Students who participated in TOPS were predicted to maintain 6.11 WRCM more than students who did not participate. Students eligible for FRL were expected to maintain 2.57 WRCM more than ineligible peers. This indicates that students eligible for FRL who participated in TOPS were predicted to lose approximately 2 WRCM more over the summer compared to students who were neither FRL nor participated in TOPS (i.e., 6.11 + 2.57 – 10.67 = -1.99). Thus, students eligible for FRL that participated in TOPS were predicted to have a relative disadvantage.

FRL. There was a significant effect of FRL in grade 3 in models 3 and 4. In model 4 for third grade, students eligible for FRL were expected to maintain nearly 18 WRCM more than ineligible peers. There was a significant interaction for FRL x SLS, such that students eligible for FRL did not experience as great of a protective effect of increases in SLS. Students who were not eligible for FRL experienced a *gain* of 1.29 WRCM for every point gained on the summer activities survey, whereas students eligible for FRL *lost* .77 WRCM per one-point increase on the summer activities survey.

FRL was significant at the $p \leq 0.05$ level in kindergarten in Model 4 only (see Table 18). In Model 4 for kindergarten, students eligible for FRL were predicted to maintain approximately 11 letter sounds more than ineligible peers. The FRL x TOPS interaction was significant at the $p \leq 0.05$ level in Model 3 for grade 5, and was interpreted in the previous section.

Discussion

The purpose of this study was to estimate the influences of various summer activities, such as home literacy activities and summer program participation, on summer learning loss in reading. The results indicated that participation in school-sponsored summer programs had little impact on summer change in the primary grades. There was also little effect of home-based literacy activities as measured by the self-report SLS survey.

There are multiple reasons why the present study may not have found a consistent effect of summer activities (e.g., SLS, FC, or TOPS) on learning loss. First, there was not standardized literacy instruction in TOPS, the academic summer program, or FC, the childcare program. There was not a reading or literacy curriculum provided for TOPS teachers, and the program only lasted 4 hours per day for 5 weeks. Given the number of activities in the TOPS program (i.e., math, literacy, gym, specialist, breakfast, and snack) it is likely that students spent less than 60 minutes per day on reading or literacy activities, accumulating to fewer than 25 reading hours over the summer. Furthermore, exposure to reading time in FC may have varied by participation, as some students attended the program full day while others only attended half day. Finally, the SLS required students to estimate the frequency with which they engaged in various summer activities, such as reading with family or reading independently. It is possible that students were unable to accurately estimate these activities.

Although previous research indicated there were differences in summer activities for high and low SES students (e.g., Burkam et al., 2004), and that summer reading interventions had greater effect for students from low-income backgrounds (Kim & Quinn, 2013), the interactions of the summer variables and FRL were generally not significant. The one exception was the statistically significant interaction between FRL and SLS in third grade. In that case, summer activities (as measured by the SLS; see

Appendix B) were associated with an increased summer learning loss for FRL students. There was also a trend (i.e., significant at $p \leq 0.05$ but not $p \leq 0.01$) effect of FRL x TOPS in fifth grade, where students eligible for FRL that participated in TOPS had a relative disadvantage compared to non-FRL peers in TOPS.

Researchers have cautioned that summer literacy activities make little difference in the summer learning trajectory after kindergarten and account for approximately 2% in the variance of summer reading change (Burkam et al., 2004). The other two studies that included summer activity in a study of summer learning loss in reading found that time spent reading over the summer did not consistently predict vocabulary loss (Lawrence, 2009; Lawrence, 2012).

The present study found no substantial or consistent impact of either summer program (TOPS or FC) studied. Another study found that attendance of one summer program had a significant positive effect on summer trajectory while another did not (Borman, Benson, & Overman, 2005). Furthermore, whether parents practiced literacy skills with their child over the summer and had access to home learning resources over the summer did not significantly impact summer change (Borman et al., 2005). Thus, neither the present study nor a previous study (Borman et al., 2005) found an effect of some of the summer home literacy activities studied. There was not a significant interaction of SES and either summer program (Borman et al., 2005), which is similar to the results of the present study; FRL significantly interacted with a summer program in just one grade. However, the present study only included two values for FRL: not eligible and eligible for free or reduced lunch. Therefore, there is variation within both groups.

One study only found a significant effect of SES between high and low groups, where SES was a composite measure of family income, parents' education levels, and parents' occupational prestige (Burkam et al., 2004). Furthermore, in that previous study the SES variable was broken into quintiles, and differences in summer activities such as reading books were notable between the lowest and highest quintiles (Burkam et al., 2004).

A meta-analysis by Kim & Quinn (2013) reported that summer reading programs that utilized research-based instruction produced greater positive effects (d = .25-.63) than interventions that were not research-based ($d \leq .18$). Neither TOPS nor FC implemented standardized curricula, and it was not known if teachers were provided evidence-based strategies to teach literacy skills. Furthermore, previous research found that although assigning students to summer school was not enough to impact summer learning loss, there were significantly better outcomes for students whose parents made a conscious effort to promote daily attendance (Borman et al., 2005). The district in the present study did not provide attendance data, which may have better illuminated the effects of the TOPS program.

Implications

The implications of the current study are presented below for both research and practice.

Research. The results of the present study are somewhat similar to some previous studies (e.g., Borman et al., 2005; Lawrence, 2009; Lawrence, 2012) but differ from others (e.g., Burkam et al., 2004; Kim & Quinn, 2013). It is possible that the mixed findings were due to differences in subject area (i.e., Lawrence, 2009 and Lawrence, 2012 were studies of vocabulary only), as well as differences in the variables used. The present study used FRL as a proxy for SES, but in some previous research there were non-linear differences in summer activity by SES, such that in some cases there were only notable differences between high and low SES quintiles (Burkam et al., 2004). FRL, as used in the present study, was a dichotomous variable and may not have captured differences in extremes. Thus, replication is needed, and this is an important area of future research to inform summer service delivery. Future studies should include information on whether research-based strategies are used in summer programs, and include student and parent report of summer literacy or other cultural activities. They should also try to include more nuanced estimates of SES than FRL, such as parent income and/or parent education.

Practice. There were no significant positive effects of either summer program on summer learning loss in reading in the present study. However, this may be due in part to the fact that the TOPS staff were not given curriculum, and were able to design their own reading/literacy lessons. A meta-analysis found that summer reading programs can have moderately positive effects on fluency (d = .63) when research-based instruction is used (Kim & Quinn, 2013). It also indicated that summer reading programs may be more effective for students from low-income families (Kim & Quinn, 2013). Furthermore, one study found that purposeful, research-based summer programs can be effective when parents and educators collaborate to ensure attendance and research-based programming (Borman et al., 2005). Schools and districts should take these considerations into account when designing and implementing summer programs. Furthermore, they should collect data to gauge the summer programs' effectiveness, and take actionable steps to maximize effectiveness, such as tailoring instruction or intervention to students.

A Response-to-Intervention (RTI) framework offers a promising approach for meeting the instructional needs of students during summer programs while reducing resource demands. The author conducted a brief literature review and found no studies that explored the use of RTI in summer programming. The frequent measurement and assessment of student progress to guide instructional decisions would be a key element of RTI during the summer, as during the academic year. This would enable educators to identify students exhibiting a flat or negative learning trajectory in the summer program, and refer them to a supplemental group or individual intervention. As previously discussed, students at-risk of reading loss could receive a Tier II intervention in addition to core instruction in the area of concern. Following the guidelines for best practice, these Tier II interventions should occur for 20-40 minutes, three to five times per week (Gersten et al., 2009) for 8 to 16 weeks (Burns et al., 2006). Tier II interventions should be targeted, research-based, and in groups of four to six students (Burns et al., 2006).

Strengths and Limitations

This study added to a small number of studies that investigated the effect of home summer literacy activities as well as summer programs on summer learning loss in reading. The effects of intervening instructional time were minimized by testing students in the last 10 days of the school year in the spring, and the first 10 days in the fall. Surveys were read individually to students along with visual aids to maximize accuracy of responses.

The present study is not without limitations. Summer activity was self-reported by students, and may not have been accurate. Furthermore, the SLS was an author-created measure, and this was the first time it was used. No information regarding student attendance was available for either summer program. Therefore, there was no measure of fidelity of summer programming, and attendance may have varied from student to student. Some students may have attended summer programs more frequently, and may have benefitted more, while others attended less often and may not have benefitted. Finally, FRL was used as a proxy for SES, which is not the best estimate of that factor (Harwell & LeBeau, 2010). Despite its limitations, the present study has implications for future research and practice.

Final Comments

The present study found no consistent impact of summer programs or home literacy activities as reported by students on the SLS on summer learning loss in reading. This study underscores the importance of using research-based strategies in academic summer programs. Future research should replicate the present study to further illuminate the impact of summer activities, and summer programs should collect data to ensure programs are effective. Using an RTI framework may be one way to ensure students benefit from summer programming, and promote academic growth instead of instructional loss over the summer.

CHAPTER 4: Discussion and Conclusions

Research on the topic of summer learning loss emerged more than 100 years ago (e.g., White, 1906; Garfinkel, 1919; Brueckner & Distad, 1924), yet many questions remain unanswered. At present, the results of studies conducted over the past 100 years do not consistently converge to support the existence or magnitude of summer learning loss in reading. Methodological issues with the measurement of summer learning loss are likely the root cause of the inconsistent research findings (e.g., Cooper et al., 1996). The author conducted a review of literature since 1996 (see introduction section of chapters 2 and 3) and found just 15 studies of summer learning loss in reading. Only 8 of the 15 studies found an effect of summer learning loss in at least one grade studied (viz., Allinder & Eicher, 1994; Atteberry & McEachin, 2015; Henry et al., 2003; Lawrence, 2009; Lawrence, 2012; Lawrence, Rolland, Branum-Martin, & Snow, 2014; LoGerfo et al., 2006; Sandberg Patton & Reschly, 2013).

Although it seems clear that summer learning loss in reading may not affect all students, little research includes potential risk or protective factors for the loss. A better understanding of which students are most affected by summer learning loss may facilitate better identification of students most susceptible or most at-risk to experiencing summer learning loss. That knowledge, in turn, could help schools, districts, and states strategically target at-risk students through summer programs or the provision of learning materials over the summer.

In the literature review conducted by the author (see introduction to chapters 2 and 3), just three studies included SPED (viz., Allinder & Eicher, 1994; Lawrence et al., 2014; Sandberg Patton & Reschly, 2013) as a moderator of summer learning loss in reading, and three included ELL (viz., Lawrence, 2012; LoGerfo et al., 2006; Sandberg Patton & Reschly, 2013). Nine studies examined the effect of SES on summer reading loss (viz., Alexander et al., 2001; Burkam et al., 2004; Downey et al., 2004; Henry et al., 2003; Lawrence, 2012; LoGerfo et al., 2006; McCoach et al., 2006; Ready, 2010; Sandberg Patton & Reschly, 2013).

The Present Study

The present study followed previous recommendations to account for instructional time (Cooper et al., 1996) in the study of summer learning loss. The study included students who did and did not receive supplemental services during the school year (i.e., ELL, SPED, FRL) and over the summer (FC, TOPS), accounted for initial achievement, and measured and accounted for student-reported summer literacy activities at home. All students were tested in the last 10 days of the school year in the spring, and the first 10 days in the fall. The results indicated that there was a significant effect of summer learning loss in four grades: K, 2, 4, and 5. The Cohen's *d* effect sizes in these grades ranged from .52 (kindergarten) to 1.37 (fifth grade), interpreted as medium to large effects (Cohen, 1988). There was a small, non-statistically significant effect of loss in third grade ($d = .17$), and a medium effect of an average gain after first grade ($d = -.82$).

Effect of demographic variables. The first study examined summer learning loss in reading by ELL, SPED, FRL, and race. Overall, these demographic variables accounted for a small amount of the variance in summer change. FRL was not significant in any grade, race was significant ($p \leq 0.01$) only in the second kindergarten model, and SPED was not significant in any grade ($p \leq 0.01$). Although ELL was not significant in any individual grade-level model, it was significant in the model for grades 1-5 combined. In that model, there was a disadvantage for students receiving ELL services.

Effect of summer activities. The second study examined if summer activities, such as home literacy activities as measured by the SLS, or summer program enrollment were associated with more or less summer learning loss in reading. Overall, there was little effect of summer activity on summer learning loss. There was, however, a significant effect of SLS and FC in third grade. It should be noted that the TOPS program was only four hours a day for five weeks, and ended more than a month before school resumed in the fall. The TOPS teachers were not given a specific curriculum or research-based strategies for literacy instruction. The other summer program, FC, was a fee-based program and included a maximum of 1 hour of reading time a day. Furthermore, parents could choose to send their child for a full or half-day. In the FC schedule there was 30 minutes of literacy in both the morning and afternoon to ensure that students who attended half day would be exposed to at least 30 minutes of reading or literacy time. No attendance information was available for either FC or TOPS to determine fidelity of implementation. Finally, the SLS was a self-report measure, and it is possible that students were not fully truthful or accurate in their report of their summer literacy activities.

Final Comments

Although the first study in this dissertation found a significant and meaningful effect of summer learning loss in reading in four grades, variance in summer change was not fully explained by demographic variables or summer variables. Regardless, the present dissertation provided an example of a process that researchers and school staff may use to examine summer learning loss in other populations. Future studies that continue to refine the measurement of demographic variables and summer activities may begin to answer some of the questions about summer learning loss in reading.

Summer is a withdrawal of the intervention of public education, and the first study in this dissertation provided clear evidence of the negative effect of summer learning loss. The goal of educators and researchers moving forward should be to target students most susceptible to summer learning loss. The results of study one suggest that students most susceptible to summer loss cannot be found solely through demographic data. Similarly, because the results of this study did not find a consistent effect of summer programs or literacy activities on summer change, researchers need to dig deeper into factors that influence summer learning loss, and educators need to evaluate the effectiveness of summer programs in reading.

Table 1

Demographic Information by School and District

School	African American or Black	Asian	Hispanic	Native American	White	SPED	ELL	FRL
	%	%	%	%	%	%	%	%
School 1	25.5	35.9	19.1	1.5	18.1	10.6	38.4	75.7
School 2	12.0	7.4	8.7	2.4	69.5	8.3	17.4	42.1
School 3	17.6	23.0	26.5	0.9	32.0	13.9	24.6	63.0
School 4	38.5	21.1	11.6	0.8	28.0	10.8	22.7	66.5
District	17.3	21.5	12.6	0.7	47.9	13.1	16.7	46.8

Note. SPED = Eligibility for special education. ELL = Eligibility for English Language Learner status. FRL = Eligibility for free or reduced lunch.

Table 2

Demographic Information and Participation Rate for Schools 1-4 and Total Sample

	School 1 (*n* =241)	School 2 (*n* =179)	School 3 (*n* =229)	Total (*N* =649)
	%	%	%	%
Participation rate	60.6	30.2	42.3	41.6
White (*n* =214)	18.7	57.5	28.8	33.0
Black (*n* =130)	25.3	12.3	20.5	20.0
Asian (*n* =198)	36.9	18.4	33.2	30.5
Hispanic (*n* =96)	17.4	10.1	15.7	14.8
AI/PI (*n* =11)	1.7	1.7	1.7	1.7

Note. Participation rate refers to the percentage of students in the school who were participants in the present study. AI/PI refers to American Indian/Pacific Islander.

Table 3

FRL Eligibility by School and Grade

	School 1 (n =178)	School 2 (n =68)	School 3 (n =162)	Total (N =408)
	%	%	%	%
Kindergarten (N =43)	78.1	-	75.0	76.8
First grade (N =54)	76.9	7.7	74.2	65.0
Second grade (N =95)	72.0	41.1	78.4	59.3
Third grade (N =61)	66.7	-	68.9	67.8
Fourth grade (N =63)	77.8	33.3	68.0	62.4
Fifth grade (N =92)	75.0	42.0	64.3	57.9

Table 4

SPED Eligibility Status by School and Grade

	School 1 (*n* =24)	School 2 (*n* =14)	School 3 (*n* =31)	Total (*N* =69)
	%	%	%	%
Kindergarten (*N* =5)	9.4	-	8.3	8.9
First grade (*N* =9)	7.7	0.0	19.4	10.8
Second grade (*N* =19)	10.0	9.6	18.9	11.9
Third grade (*N* =6)	4.4	-	8.9	6.7
Fourth grade (*N* =15)	18.5	12.5	14.0	14.9
Fifth grade (*N* =15)	12.5	5.8	11.9	9.4

Table 5

ELL Status by School and Grade

	School 1 (n =82)	School 2 (n =14)	School 3 (n =46)	Total (N =142)
	%	%	%	%
Kindergarten (N =24)	53.1	-	29.2	42.9
First grade (N =27)	46.2	0.0	29.0	32.5
Second grade (N =38)	38.0	12.3	27.0	23.8
Third grade (N =23)	37.8	-	13.3	25.6
Fourth grade (N =12)	14.8	0.0	16.0	11.9
Fifth grade (N =18)	14.6	7.2	14.3	11.3

Table 6

Stepwise Models with Demographic Variables and Interactions for Study One

KG	Model 1	Model 2	Model 3	Model 4
Intercept	-2.97 (3.05)	-9.68 (7.44)	-7.67 (7.43	-11.00* (5.54)
SSA	-0.06 (0.10)	-0.05 (0.12)	-0.03 (0.11)	-0.02 (0.09)
ELL		-3.38 (2.88)	-3.86 (2.99)	
FRL		0.70 (2.90)	-4.57 (5.84)	
Race		9.50** (3.14)	4.32 (4.79)	8.09* (3.59)
SPED		-3.43 (2.75)	-5.79 (3.97)	
ELL x SPED			-0.62 (4.46)	
FRL x Race			8.40 (6.28)	
Race x SPED			4.07 (4.09)	
r^2	0.01	0.14	0.17	0.11
r^2 Change		0.13	0.16	0.10
First grade	Model 1	Model 2	Model 3	Model 4
Intercept	-5.30* (2.14)	-2.31 (5.41)	-1.77 (5.49)	
SSA	0.47** (0.05)	0.45** (0.07)	0.46** (0.07)	
ELL		-0.96 (3.25)	-1.54 (3.76)	
FRL		-0.47 (4.26)	-4.40 (7.18)	
Race		-3.24 (3.92)	-6.16 (4.65)	
SPED		6.44 (4.17)	6.30 (6.28)	
ELL x SPED			-0.11 (7.12)	
FRL x Race			6.76 (8.46)	

r^2	0.47	0.49	0.50	
r^2 Change		0.02	0.03	

Second grade	Model 1	Model 2	Model 3	Model 4
Intercept	-0.84 (1.89)	0.21 (3.63)	0.22 (3.63)	1.14 (2.61)
SSA	-0.09** (0.02)	-0.10** (0.02)	-0.10** (0.03)	-0.10** (0.02)
ELL		-2.31 (2.47)	-2.80 (2.55)	-2.97 (2.50)
FRL		1.87 (3.02)	3.40 (4.61)	
Race		-1.00 (2.77)	0.91 (3.82)	
SPED		-2.88 (2.48)	-4.90 (3.77)	-5.17* (2.57)
ELL x SPED			11.64** (4.11)	11.86** (3.70)
FRL x Race			-3.60 (5.80)	
Race x SPED			0.00 (4.93)	
r^2	0.08	0.09	0.10	0.10
r^2 Change		0.01	0.02	0.02

Third grade	Model 1	Model 2	Model 3	Model 4
Intercept	-11.51** (3.74)	-14.17* (6.72)	-13.79 (7.16)	
SSA	0.08* (0.03)	0.11** (0.04)	0.12** (0.04)	
ELL		4.70 (4.36)	3.97 (4.47)	
FRL		0.63 (3.46)	-5.95 (7.93)	
Race		-3.96 (4.14)	-7.18 (5.41)	
SPED		7.50 (4.14)	16.35* (7.39)	
ELL x SPED			13.03 (8.91)	
FRL x Race			8.97 (8.96)	

Race x SPED			-16.4 (9.31)	
r^2	0.05	0.08	0.11	
r^2 Change		0.03	0.06	
Fourth grade	Model 1	Model 2	Model 3	Model 4
Intercept	19.33** (4.88)	20.00** (7.45)	19.50** (7.40)	
SSA	-0.25** (0.03)	-0.26** (0.04)	-0.25** (0.04)	
ELL		-3.41 (4.55)	-0.76 (5.24)	
FRL		-2.42 (2.79)	-4.87 (4.87)	
Race		3.08 (3.07)	-0.71 (4.50)	
SPED		1.28 (3.73)	1.27 (4.38)	
ELL x SPED			-14.52 (9.77)	
FRL x Race			5.53 (5.67)	
FRL x SPED			-2.99 (5.63)	
Race x SPED			8.10 (6.56)	
r^2	0.45	0.46	0.48	
r^2 Change		0.01	0.03	
Fifth grade	Model 1	Model 2	Model 3	Model 4
Intercept	10.36** (3.91)	15.92** (5.58)	14.56** (5.65)	
SSA	-0.16** (0.02)	-0.19** (0.03)	-0.19** (3.69)	
ELL		-5.84 (3.14)	-4.49 (3.69)	
FRL		-2.67 (2.17)	1.75 (3.39)	
Race		2.39 (2.04)	5.80* (2.89)	
SPED		-1.31 (2.63)	-3.31 (2.80)	

ELL x SPED			-3.72 (6.93)	
FRL x Race			-7.64 (4.10)	
Race x SPED			3.76 (4.38)	
r^2	0.25	0.27	0.29	
r^2 Change		0.02	0.04	
Grades 1-5	Model 1	Model 2	Model 3	Model 4
Intercept	11.16** (1.45)	17.08** (2.45)	16.76** (2.59)	16.53** (2.02)
SSA	-0.17** (0.01)	-0.14** (0.02)	-0.14** (0.02)	-0.14** (0.02)
ELL		-5.30** (1.75)	-4.73** (1.90)	-5.47** (1.69)
FRL		-1.45 (1.59)	-0.00 (2.65)	
Race		0.76 (1.59)	2.75 (2.43)	
SPED		-0.75 (1.85)	-3.61 (4.24)	
Grade		-2.33** (0.79)	-2.34** (0.79)	-2.47** (0.78)
ELL x SPED			-1.68 (3.80)	
FRL x Race			-3.67 (3.24)	
FRL x SPED			6.19 (4.21)	
Race x SPED			-1.47 (4.68)	
r^2	0.29	0.32	0.32	0.32
r^2 Change		0.03	0.03	0.03

Note. SSA = Spring score adjusted. SPED = Eligibility for special education. ELL = Eligibility for English Language Learner status. FRL = Eligibility for free or reduced lunch. r^2 = percentage of variance explained by the model. r^2 Change = change in r^2 from Model 1. Single asterisks indicate significance at $p \leq 0.05$. Double asterisks indicate significance at $p \leq 0.01$.

Table 7

T-test Results by Grade

	t-value	*p*-value
Kindergarten (N =56)	3.90	≤0.00*
First grade (N =83)	-7.50	≤0.00*
Second grade (N =160)	8.67	≤0.00*
Third grade (N =90)	1.59	0.116
Fourth grade (N =101)	11.88	≤0.00*
Fifth grade (N =159)	17.22	≤0.00*

Note. Asterisks indicate that the *p*-value is significant at $p \leq 0.05$.

Table 8

Comparison of Participant Sample Means and Norms

	Spring 2016 Adjusted *M* (*SD*)	Spring 2016 Unadjusted *M* (*SD*)	Corresponding Percentile Norms Spring 2016	Fall 2017 Adjusted *M* (*SD*)	Fall 2017 Unadjusted *M* (*SD*)	Corresponding Percentile Norms Fall 2016
Kindergarten (*N* =56)	-	37.7 (14.8)	30th	-	32.4 (17.2)	60th
First grade (*N* =83)	43.3 (26.6)	84.4 (47.7)	55th	58.1 (41.1)	66.2 (47.3)	50th
Second grade (*N* =160)	92.6 (41.6)	105.9 (47.9)	40th	83.1 (40.0)	87.3 (45.7)	35th
Third grade (*N* =90)	115.9 (39.7)	124.8 (45.4)	35th	113.5 (45.1)	109.1 (41.5)	30th
Fourth grade (*N* =101)	162.1 (48.5)	153.9 (44.6)	45th	140.8 (38.7)	133.0 (40.4)	40th
Fifth grade (*N* =159)	179.4 (41.9)	173.4 (43.7)	55th	160.8 (37.0)	152.5 (42.8)	50th

Note. Kindergarten data represent letter sounds correct per minute while data for grades 1-5 are letter sounds correct per minute. The percentile indicates the corresponding percentile for the unadjusted score at that grade and season (Christ et al., 2016). Spring norms are for the corresponding grade, while fall norms are for the grade following summer (e.g., second grade fall norms for first grade).

Table 9

Cohen's d Effect Sizes

Grade	*d*	CI Low	CI High
KG	0.522	0.137	0.906
First	-0.824	-1.145	-0.502
Second	0.685	0.458	0.912
Third	0.167	-0.129	0.464
Fourth	1.182	0.879	1.484
Fifth	1.366	1.12	1.611
Grades 1-5	0.493	0.377	0.609

Note. *d* = Cohen's d effect size, CI = 95% confidence interval.

Table 10

Reliable Change

Grade	Critical Value	% Reliable change	% Reliable gain	% Reliable loss
KG	10.90	35.7	5.3	30.4
1st	19.60	34.9	33.7	1.2
2nd	15.68	30.7	1.9	28.8
3rd	17.64	23.4	7.8	15.6
4th	17.64	52.5	0.0	52.5
5th	21.56	43.4	0.0	43.4

Table 11

Grade-level Mean Summer Change in Weeks of Instructional Loss

Grade	Summer Change	Deno Weekly Growth	Deno Weeks Gained/Lost	FBL Weekly Growth	FBL Weeks Gained/Lost
KG	-5.3	N/A	N/A	0.99	-5.4
1st	14.8	1.8	8.2	1.38	10.7
2nd	-9.5	1.66	-5.7	1.32	-7.2
3rd	-2.4	1.18	-2.0	1.13	-2.1
4th	-21.3	1.01	-21.1	1.00	-21.3
5^{th}	-18.6	0.58	-32.1	0.90	-20.7

Note. Summer change is mean difference between fall median WRCM and spring median WRCM. Deno Weekly Growth is the estimated weekly change in WRCM by grade (Deno, Fuchs, Marston, & Shin, 2001). Deno Weeks Gained/Lost is Summer Change divided by Deno Weekly Growth, or instructional weeks gained or lost over the summer. FBL Weekly Growth is the estimated weekly changed in WRCM from FastBridge Learning published norms (Christ et al., 2016).

Table 12

Demographic Information by School and District

School	African American or Black	Asian	Hispanic	Native American	White	SPED	ELL	FRL
	%	%	%	%	%	%	%	%
School 1	25.5	35.9	19.1	1.5	18.1	10.6	38.4	75.7
School 2	12.0	7.4	8.7	2.4	69.5	8.3	17.4	42.1
School 3	17.6	23.0	26.5	0.9	32.0	13.9	24.6	63.0
School 4	38.5	21.1	11.6	0.8	28.0	10.8	22.7	66.5
District	17.3	21.5	12.6	0.7	47.9	13.1	16.7	46.8

Note: SPED = Eligibility for special education. ELL = Eligibility for English Language Learner status. FRL = Eligibility for free or reduced lunch.

Table 13

Demographic Information and Participation Rate for Schools 1-4 and Total Sample

	School 1 (*n* =241)	School 2 (*n* =179)	School 3 (*n* =229)	Total (*N* =649)
	%	%	%	%
Participation rate	60.6	30.2	42.3	41.6
White (*n* =214)	18.7	57.5	28.8	33.0
Black (*n* =130)	25.3	12.3	20.5	20.0
Asian (*n* =198)	36.9	18.4	33.2	30.5
Hispanic (*n* =96)	17.4	10.1	15.7	14.8
PAI/PI (*n* =11)	1.7	1.7	1.7	1.7

Note. Participation rate refers to the percentage of students in the school who were participants in the present study

Table 14

Summer Program Participation Rates

Grade	FC	TOPS	FC & TOPS
KG	8 (14.3%)	27 (48.2%)	3 (5.4%)
1st	7 (8.4%)	30 (36.1%)	3 (3.6%)
2nd	26 (16.3%)	42 (26.3%)	9 (5.6%)
3rd	5 (5.6%)	26 (28.9%)	0 (0.0%)
4th	5 (5.0%)	36 (35.6%)	2 (2.0%)
5th	9 (5.7%)	43 (27.0%)	3 (5.4%)

Note. FC = Friendship Connection summer program attendance. TOPS = TOPS summer program attendance.

Table 15

Summer Literacy Survey Coefficient Alpha Values by Grade

Grade	Alpha	Split-half Reliability	
		r	*Adjusted r*
KG	0.73	0.66	0.80
1st	0.68	0.48	0.65
2nd	0.73	0.62	0.76
3rd	0.59	0.49	0.66
4th	0.64	0.47	0.64
5th	0.69	0.59	0.74

Note. r indicates the correlation between split halves of the survey. Adjusted *r* transforms *r* using the Spearman-Brown prophecy formula.

Table 16

Summer Literacy Survey Means by Item and Overall for Kindergarten Survey

Grade	1. Read with family	2. Books at home	2a. Books you can read?	4. Went to library	5. Reading games	6. Practice letters	7. Practice writing	Total
KG	0.53	0.89	0.55	0.62	0.45	0.70	0.68	4.42

Note. Answer of “Yes” coded as 1, answer of “No” coded as 0.

Table 17

Summer Literacy Survey Means by Item and Overall for Grades 1-5 Survey

Grade	1. Read with family	2. Read by yourself	3. Went to library	4. Reading games	5. Practice spelling	6. Practice writing	Total
1st	1.75	2.21	0.78	1.13	1.52	1.52	8.91
2nd	1.91	2.21	1.19	0.89	1.50	1.89	9.59
3rd	1.45	1.98	0.66	1.01	1.16	1.60	7.86
4th	1.36	2.48	0.97	0.81	1.08	1.80	8.50
5th	1.13	2.35	1.00	0.80	0.88	1.40	7.56

Note. There were five possible answers to each survey question (code for scoring in parentheses): Never (0), Once or twice all summer (1), Every month (2), Every week (3), Every day/almost every day (4)

Table 18

Stepwise Models with Summer Variables for Study Two

KG	Model 1	Model 2	Model 3	Model 4
Intercept	-11.00* (5.54)	-7.90 (5.75)	-13.87** (4.43)	-16.52** (5.89)
SSA	-0.02 (0.09)	-0.02 (0.10)	-0.04 (0.10)	-0.00 (0.10)
Race	8.09* (3.59)	8.37* (3.82)	17.32** (4.72)	7.57* (3.59)
SLS		-0.40 (0.63)	0.65 (1.53)	1.60 (1.43)
FC		-1.18 (3.79)	3.27 (5.60)	-3.45 (6.92)
TOPS		-2.08 (2.75)	2.45 (6.02)	-1.25 (5.32)
FRL				10.99* (5.24)
Race x FC			-7.69 (7.15)	
Race x TOPS			-5.52 (6.55)	
Race x SLS			-1.34 (1.65)	
FRL x FC				1.34 (9.21)
FRL x TOPS				-0.02 (6.23)
FRL x SLS				-2.57 (1.57)
r^2	0.11	0.12	0.16	0.16
r^2 Change		0.01	0.05	0.05
First grade	Model 1	Model 2	Model 3	Model 4
Intercept	-5.30* (2.14)	-9.13* (4.11)	-6.89 (8.54)	
SSA	0.46** (0.05)	0.52** (0.05)	0.49** (0.07)	
SLS		0.15 (0.28)	0.41 (0.67)	
FC		-0.98 (3.45)	-2.58 (4.36)	

TOPS		2.61 (3.07)	-5.34 (6.28)	
FRL			-3.44 (8.51)	
FRL x FC			3.64 (7.37)	
FRL x TOPS			11.37 (7.33)	
FRL x SLS			-0.20 (0.74)	
r^2	0.47	0.51	0.53	
r^2 Change		0.04	0.06	
Second grade	Model 1	Model 2	Model 3	Model 4
Intercept	1.14 (2.61)	-0.76 (3.56)	-4.77 (5.09)	
SSA	-0.10** (0.02)	-0.09** (0.03)	-0.08** (0.03)	
ELL	-2.97 (2.50)	-1.94 (2.77)	-3.60 (2.98)	
SPED	-5.17* (2.57)	-4.35 (2.85)	-3.41 (2.99)	
ELL x SPED	11.86** (3.70)	11.88** (3.85)	11.03** (4.23)	
SLS		0.02 (0.21)	0.18 (0.35)	
FC		0.72 (2.84)	2.92 (4.03)	
TOPS		-1.74 (2.63)	-5.11 (3.71)	
FRL			5.78 (5.08)	
FRL x FC			-3.90 (5.70)	
FRL x TOPS			5.21 (4.99)	
FRL x SLS			-0.28 (0.43)	
r^2	0.10	0.09	0.12	
r^2 Change		-0.01	0.02	
Third grade	Model 1	Model 2	Model 3	Model 4
Intercept	-11.51**	-10.80**	-26.10**	-21.31**

	(3.74)	(4.17)	(5.65)	(5.35)
SSA	0.08* (0.03)	0.08** (0.03)	0.07* (0.03)	0.07* (0.03)
SLS		-0.15 (0.35)	1.65** (0.48)	1.29** (0.46)
FC		-2.42 (3.70)	-18.02** (5.69)	-7.14 (4.69)
TOPS		1.17 (3.40)	6.90 (5.42)	
FRL			21.89** (5.67)	17.79** (5.23)
FRL x FC			13.71 (7.43)	
FRL x TOPS			-6.64 (6.74)	
FRL x SLS			-2.38** (0.61)	-2.06** (0.61)
r^2	0.05	0.05	0.15	0.13
r^2 Change		0.00	0.10	0.08

Fourth grade	Model 1	Model 2	Model 3	Model 4
Intercept	19.33** (4.88)	18.37** (5.86)	26.62** (7.40)	
SSA	-0.25** (0.03)	-0.25** (0.03)	-0.26** (0.03)	
SLS		0.20 (0.29)	-0.46 (0.48)	
FC		8.18 (4.97)	7.97 (4.46)	
TOPS		-1.68 (2.91)	-1.96 (4.82)	
FRL			-11.57 (6.04)	
FRL x TOPS			-0.35 (5.97)	
FRL x SLS			1.12 (0.613)	
r^2	0.45	0.45	0.47	
r^2 Change		0.00	0.02	

Fifth grade	Model 1	Model 2	Model 3	Model 4
Intercept	10.36**	9.01*	9.22	

	(3.91)	(4.40)	(5.75)	
SSA	-0.16**	-0.17**	-0.17**	
	(0.02)	(0.03)	(0.03)	
SLS		0.22	0.32	
		(0.26)	(0.38)	
FC		-0.83	-0.57	
		(2.65)	(3.15)	
TOPS		0.55	6.11*	
		(2.29)	(2.98)	
FRL			2.57	
			(4.38)	
FRL x TOPS			-10.67*	
			(4.37)	
FRL x SLS			-0.22	
			(0.48)	
r^2	0.25	0.23	0.27	
r^2 Change		-0.02	0.02	
Grades 1-5	Model 1	Model 2	Model 3	Model 4
Intercept	16.53**	16.27**	15.76**	
	(2.02)	(2.70)	(3.44)	
SSA	-0.14**	-0.14**	-0.14**	
	(0.02)	(0.02)	(0.02)	
ELL	-5.47**	-4.76**	-4.72**	
	(1.69)	(1.90)	(1.93)	
SLS		0.06	0.15	
		(0.14)	(0.26)	
FC		-0.18	-3.96	
		(2.36)	(4.58)	
TOPS		-0.69	0.18	
		(1.52)	(2.51)	
Grade	-2.47**	-2.46**	-2.47**	
	(0.78)	(0.85)	(0.84)	
FRL			0.98	
			(3.04)	
FRL x FC			5.20	
			(5.34)	
FRL x TOPS			-1.30	
			(3.11)	
FRL x SLS			-0.13	
			(0.31)	
r^2	0.32	0.31	0.32	
r^2 Change		-0.01	0.00	

Note. SPED = Eligibility for special education. ELL = Eligibility for English Language Learner status. FRL = Eligibility for free or reduced lunch. Friendship Connection summer program attendance. TOPS = TOPS summer program attendance. r^2 = percentage of variance explained by the model. r^2 Change = change in r^2 from Model 1. Single asterisks indicate significance at $p \leq 0.05$. Double asterisks indicate significance at $p \leq 0.01$.

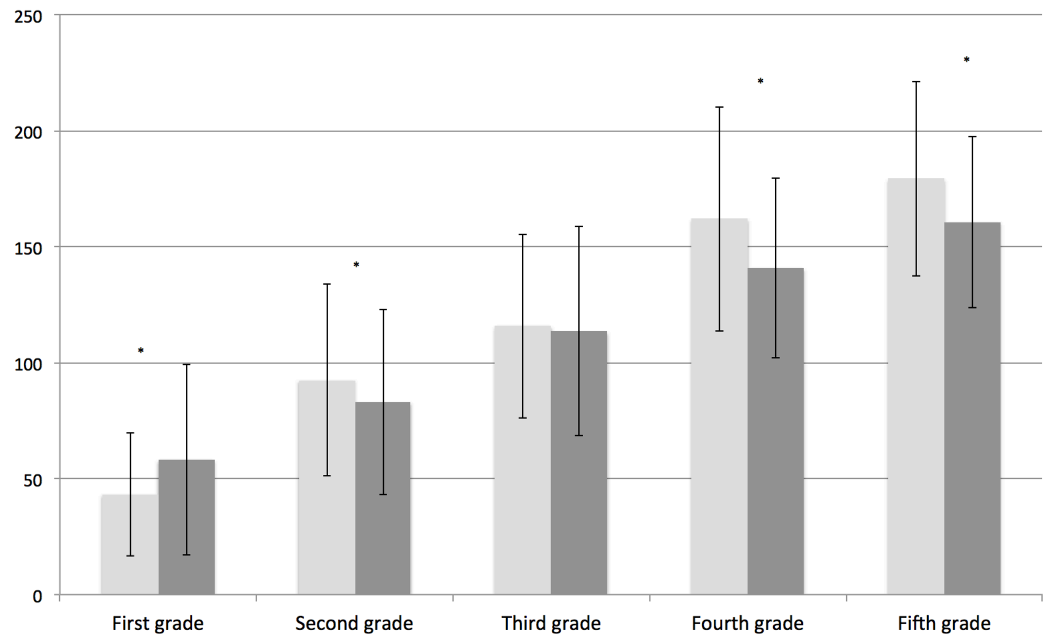

Figure 1. Mean spring (light gray) and fall (dark gray) WRCM by grade. Asterisks indicate significant change. Whiskers indicate one SD.

References

Allinder, R. M. & Eicher, D. D. (1994). Bouncing back. *Special Services in the Schools, 8*(2), 129-142.

Allington, R. L., McGill-Franzen, A., Camilli, G., Williams, L., Graff, J., Zeig, J., Zmach, C., & Nowak, R. (2010). Addressing summer reading setback among economically disadvantaged elementary students. *Reading Psychology, 31*, 411-427.

Alexander, K. L., Entwisle, D. R., & Olson, L. S. (2001). Schools, achievement, and inequality: A seasonal perspective. *Educational Evaluation and Policy Analysis, 23*(2), 171-191.

Atteberry, A. & McEachin, A. (2015). School's out: The role of summers in understanding achievement disparities. Manuscript submitted for publication.

Baker, J. & Christ, T. C. (2015). *Summer learning loss in reading achievement.* Unpublished manuscript, University of Minnesota – Twin Cities, MN.

Batsche, G., Elliott, J., Graden, J. L., Grimes, J., Kovaleski, J. F., Prasse, D., et al. (2005). *Response to intervention policy considerations and implementation.* Reston, VA: National Association of State Directors of Special Education.

Borman, G. D., Benson, J., & Overman, L. T. (2005). Families, schools, and summer learning. *The Elementary School Journal, 106*(2), 131-150.

Burkam, D. T., Ready, D. D., Lee, V. E., & LoGerfo, L. F. (2004). *Sociology of Education, 77*(1), 1-31.

Brueckner, L. J., & Distad, H. W. (1924). The effect of the summer vacation on the reading ability of first-grade children. *The Elementary School Journal, 24*, 698-707.

Bryant, D. P., Vaughn, S., Linan-Thompson, S., Ugel, N., Hamff, A., & Hougen, M. (2000). Reading outcomes for students with and without reading disabilities in general education middle-school content area classes. *Learning Disability Quarterly*, *23*(4), 238-252.

Burns, M. K., Hall-Lande, J., Lyman, W., Rogers, C., & Tan, C. S. (2006). Tier II interventions within response-to-intervention: Components of an effective approach. *Communiqué, 35*(4), 38-40.

Chall, J. S. (1983). *Stages of reading development*. New York, NY: McGraw-Hill.

Christ, T. J., Arañas, Y. A., Kember, J. M., Kiss, A. J., McCarthy-Trentman, A., Monaghen, B. D., Newell, K. W., Van Norman, E. R., White, M. J. (2014). *Formative Assessment System for Teachers Technical Manual: earlyReading, CBMReading, aReading, aMath, and earlyMath.* Minneapolis, MN: Formative Assessment System for Teachers.

Christiansen, J., Christiansen, J. L., & Howard, M. (1997). Using protective factors to enhance resilience and school success for at-risk students. *Intervention in school and clinic, 33*(2), 86-89.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Earlbaum Associates.

Cooper, H. (2003). *Summer learning loss: The problem and some solutions.* ERIC Clearinghouse on Elementary and Early Childhood Education. Retrieved from: http://www.ericdigests.org/2003-5/summer.htm

Cooper, H., Charlton, K., Valentine, J. C., & Muhlenbruck, L. (2000). Making the most of summer school: A meta-analytic and narrative review. *Monographs of the Society for Research in Child Development, 65*(Serial No. 260), 1–118.

Cooper, H., Nye, B., Charlton, K., Lindsay, J., & Greathouse, S. (1996). The effects of summer vacation on achievement test scores: A narrative and meta-analytic review. *Review of Educational Research, 66*(3), 227-268.

Corcoran, J., & Nichols-Casebolt, A. (2004). Risk and resilience ecological framework for assessment and goal formulation. *Child and adolescent social work journal, 21*(3), 211-235.

Cordrey v Euckert, 917 F.2d 1460 (6th Cir. 1990).

Cronbach, L. J. & Furby, L. (1970). How should we measure “change”: Or should we? *Psychological Bulletin, 74*(1), 68-80.

Cunningham, A. E., & Stanovich, K. E. (1997). Early reading acquisition and its relation to reading experience and ability 10 years later. *Developmental Psychology, 33*(6), 934-945.

Deno, S. L., Fuchs, L. S., Marston, D., & Shin, J. (2001). Using curriculum-based measurements to establish growth standards for students with learning disabilities. *School Psychology Review*, *30*(4), 507.

Deno, S. L. (2005) Problem-solving assessment with Curriculum-based Measurement (CBM). In Rachel Chidsey-Brown (Ed.) *Problem-Solving Based Assessment for Educational Intervention.* New York, NY: Guilford Press.

Downey, D. B., Von Hippel, P. T., & Broh, B. A. (2004). Are schools the great equalizer? Cognitive inequality during the summer months and the school year. *American Sociological Review, 69*(5), 613-635.

Etscheidt, S. (2002). Extended school year services: A review of eligibility criteria and program appropriateness. *Research and Practice for Persons with Severe Disabilities*, *27*(3), 188-203.

Fox, J. (2008). *Applied regression analysis and generalized linear models*. Thousand Oaks, CA: Sage Publications Inc.

Fuchs, L. S., & Deno, S. L. (1991). Paradigmatic distinctions between instructionally relevant measurement models. *Exceptional children, 57*(6), 488-500.

Garfinkel, M. A. (1919). The effect of summer vacation on ability in the fundamentals of arithmetic. *The Journal of Educational Psychology, 10*, 44-48.

Gersten, R., Compton, D., Connor, C. M., Dimino, J., Santoro, L., Linan-Thompson, S., et al. (2009). *Assisting students struggling with reading: Response to intervention and multi-tier intervention in primary grades*. Washington, DC: U.S. Department of Education Institute of Educational Sciences.

Harwell, M., & LeBeau, B. (2010). Student eligibility for a free lunch as an SES measure in education research. *Educational Researcher, 39*(2), 120-131.

Helf, S., Konrad, M., & Algozzine, B. (2008). Recouping and rethinking the effects of summer vacation on reading achievement. *Journal of Research in Reading, 31*(4), 420-428.

Henry, G. T., Henderson, L. W., Ponder, B. D., Gordon, C. S., Mashburn, W. J., & Rickman, D. K . (2003). *Report of the findings from the Early Childhood Study: 2001-02*. Atlanta, GA: Georgia State University Education Policy Group.

Heyns, B. (1978). *Summer learning and the effects of schooling* (pp. 227-268). New York: Academic Press.

Hernandez, D. J. (2011). *Double jeopardy: How third grade reading skills and poverty influence high school graduation*. The Annie E. Casey Foundation. Retrieved from: http://files.eric.ed.gov/fulltext/ED518818.pdf

Huber, Peter J. (1967). The behavior of maximum likelihood estimates under nonstandard conditions. *Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability, 1*, 221—233. Berkeley, CA: University of California Press.

Individuals with Disabilities Education Improvement Act of 2004, 20 U.S.C. § 33300 *et seq*. (2004)(reauthorization of the Individuals with Disabilities Education Act).

Jacob, S., Decker, D. M., & Hartshorne, T. S. (2011). *Ethics and law for school psychologists*. Hoboken, NJ: John Wiley & Sons, Inc.

Johnson v. Independent School District No. 4 of Bixby, 17 IDELR 170 10th Cir. (1990).

Juel, C. (1988). Learning to read and write: A longitudinal study of 54 children from first through fourth grades. *Journal of Educational Psychology, 80*, 437–447.

Katsiyannis, A. (1991). Extended school year policies: An established necessity. *Remedial and Special Education, 12*(1), 24-28.

Kim, J. S. (2006). Effects of a voluntary summer reading intervention on reading achievement: Results from a randomized field trial. *Educational Evaluation and Policy Analysis, 28*(4), 335-355.

Kim, J. S., & Quinn, D. M. (2013). The effects of summer reading on low-income children's literacy achievement from kindergarten to grade 8: A meta-analysis of classroom and home interventions. *Review of Educational Research, 83*(3), 386-431.

Lawrence, J. F. (2009). Summer reading: Predicting adolescent word learning from aptitude, time spent reading, and text type. *Reading Psychology, 30*(5), 445-465.

Lawrence, J. F. (2012). English vocabulary trajectories of students whose parents speak a language other than English: steep trajectories and sharp summer setback. *Reading and Writing, 25*(5), 1113-1141.

Lawrence, J. F., Rolland, R. G., Branum-Martin, L., & Snow, C. (2014). Generating vocabulary knowledge for at-risk middle school readers: Contrasting program effects and growth trajectories. *Journal of Education for Students Placed at Risk, 19*(2), 76-97.

LoGerfo, L., Nichols, A., & Reardon, S. F. (2006). *Achievement gains in elementary and high school.* Urban Institute, Washington, DC.

Maas, C. J. M., & Hox, J. (2005). Sufficient sample sizes for multilevel modeling. *Methodology, 1*(3), 86-92.

McCoach, D. B., O'Connell, A. A., Reis, S. M., & Levitt, H. A. (2006). Growing readers: A hierarchical linear model of children's reading growth during the first 2 years of school. *Journal of Educational Psychology, 98*(1), 14-28.

Oakes, J. M. & Feldman, H. A. (2001). Statistical power for nonequivalent pretest-postest designs: The impact of change-score versus ANCOVA models. *Evaluation Review, 25*(1), 3-28.

Pfost, M., Hattie, J., Dörfler, T., & Artelt, C. (2014). Individual differences in reading development: A review of 25 years of empirical research on Matthew effects in reading. *Review of Educational Research, 84*(2), 203-244.

R Core Team. (2014). *R: A Language and Environment for Statistical Computing. Vienna, Austria: R Foundation for Statistical Computing.* Retrieved from: http://www.R-project.org

Rambo-Hernandez, K. E., & McCoach, D. B. (2015). High-achieving and average students' reading growth: Contrasting school and summer trajectories. *The Journal of Educational Research, 108*(2), 112-129.

Ready, D. D. (2010). Socioeconomic disadvantage, school attendance, and early cognitive development: The differential effects of school exposure. *Sociology of Education, 83*(4), 271-286.

Reusch v. Fountain, 872 F. Supp. 1421 (D. Md. 1994).

Sandberg Patton, K. L., & Reschly, A. L. (2013). Using curriculum-based measurement to examine summer learning loss. *Psychology in the Schools, 50*(7), 738-753.

Slates, S. L., Alexander, K. L., Entwisle, D. R., & Olson, L. S. (2012). Counteracting summer slide: Social capital resources within socioeconomically disadvantaged families. *Journal of Education for Students Placed at Risk, 17*(3), 165-185.

Snijders, T. A. B., & Bosker, R. J. (1999). *Multilevel Analysis: An introduction to basic and advanced multilevel modeling.* Thousand Oaks, CA: Sage.

Theodore J. Christ and Colleagues. (2013). *CBMReading Observing & Rating Administrator Accuracy (ORAA)*. Minneapolis, MN: FastBridgeLearning.

Theodore J. Christ and Colleagues. (2013). *earlyReading One-Minute Measures Observing & Rating Administrator Accuracy (ORAA)*. Minneapolis, MN: FastBridgeLearning.

Torgesen, J. K., & Burgess, S. R. (1998). Consistency of reading-related phonological processes throughout early childhood: Evidence from longitudinal-correlational and instructional studies. In J. Metsala & L. Ehri (Eds.), *Word recognition in beginning reading* (pp. 161–188). Hillsdale, NJ: Erlbaum.

Tourangeau, K., Nord, C., Lê, T., Sorongon, A.G., Hagedorn, M.C., Daly, P., and Najarian, M. (2015). *Early Childhood Longitudinal Study, Kindergarten Class of 2010–11 (ECLS-K:2011), User's Manual for the ECLS-K:2011 Kindergarten Data File and Electronic Codebook, Public Version* (NCES 2015-074). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP). *2015 Mathematics and Reading Assessments*. Retrieved from: http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2015136

U.S. Department of Education, National Center for Education Statistics. Early Childhood Longitudinal Study-Kindergarten Class of 1998–99 (ECLS–K). (2002). *Psychometric Report for Kindergarten Through First Grade, NCES 2002–05*, by Donald A. Rock and Judith M. Pollack, Educational Testing Service, Elvira Germino Hausken, project officer. Washington, DC: Author.

U.S. Department of Education: National Center for Education Statistics. (2004). *The summer after kindergarten: Children's activities and library use by household socioeconomic status.* Washington, DC: Author.

White, W. F. (1906). Reviews before and after vacation. *American Education, 10*, 185-188. White, H. (1982). Maximum likelihood estimation of misspecified models. *Econometrica, 50*, 1-25.

Willett, J. B. (1988). Questions and answers in the measurement of change. *Review of Research in Education, 15*, 345-422.

Appendix A

CBMReading

Observing & Rating Administrator Accuracy (ORAA)

This tool is used for training and coaching to standardize administration of CBMReading for FAST. The observer circles a "1" if the procedure was completed accurately and a "0" if not. If the step was not applicable for this administration, write N/A. 100% accuracy is required.

Examiner: ____________________ **Date:** ___________ **Observer:**__________________

1 – Completed Accurately **0 – Completed Inaccurately**

	Testing Steps	Passage 1	Passage 2	Passage 3
1.	Reads appropriate introduction directions.			
2.	Places copy of passage in front of student.			
3.	Follows long or short form standardized directions: (*POINT TO THE TITLE and SAY*): "This is a story about____ (title). When I say, "BEGIN," start reading aloud and **READ ACROSS THE PAGE** (point to the first word, across the first line). Try to read **EACH WORD.** If you come to a word that you **DON'T KNOW,** I'll tell it to you. <u>Be sure to do your BEST reading</u>. Ready/OK? (pause). OR (*POINT TO THE TITLE and SAY*): This is a story about_____(title). <u>Be sure to do your BEST reading.</u> Ready/OK? (pause).	*Circle any areas in the directions that were not stated.*		
4.	Says "BEGIN".			
5.	Starts timer immediately when child says the first word.			
6.	Promotes best reading with well-paced directions, emphasis on "BEST" in directions, subtle use of stopwatch, and restarts student if they speed read by saying, "This is not a speed reading activity. Be sure to do your BEST reading."			
7.	Examiner follows along as student reads aloud.			
8.	Provides appropriate 3-second rule responses when needed.			
9.	Does NOT provide any other guidance to student during the test.			
10.	Says "STOP" at end of 1 minute *(uses FAST timer or stops timer/stopwatch).*			
11.	Correctly marks the last word read.			
12.	Counts errors, total words read and scores Words Read Correct.			
	Total SCORE for each passage (add all "1's" in column):	/12	/12	/12
	Optional Score Verification			
	Student score as recorded by examiner			
	Student score as recorded by observer			
	Percent Agreement*			

*Percent Agreement Formula:
<u># of Items Agreed Upon</u>
Total # of Items Completed

Figure A1. The ORAA fidelity checklist for CBM-R.

earlyReading One-Minute Measures

OBSERVING & RATING ADMINISTRATOR ACCURACY (ORAA)

This tool is used for training and coaching to standardized administration of Letter Names, Letter Sounds, Nonsense Words, Decodable Words, Sight Words, and Sentence Reading earlyReading assessments for FAST. The observer indicates if the procedure was completed accurately and not. If the step was not applicable for this administration, write N/A.

Examiner: ______________________ **Site:** ______________________

Observer: ______________________

Observation Period: O Fall O Winter O Spring

1 = Completed Accurately **0** = Completed Inaccurately

Testing Procedure	Letter Names	Letter Sounds	Nonsense Words	Decodable Words	Sight Words	Senten Readir
Date Observed						
Places practice page in front of student						
Places copy of passage in front of student.						
Places examiner materials out of view of student.						
Seated appropriate distance from student.						
Follows standardized directions						
Says **READY? BEGIN**						
Starts timer immediately when child says the first word or letter						
Examiner follows along as student provides answers aloud, marking errors as they occur						
Provides appropriate 3-second rule responses when needed.						
Does NOT provide any other guidance to student during the test.						
Says "STOP" at end of 1 minute and stops timer.						
Marks last letter, sound, or word.						
Calculates score if paper/pencil administration						

Total score	/13	/13	/13	/12	/13	/

Optional Score Verification	Letter Names	Letter Sounds	Nonsense Words	Decodable Words	Sight Words	Senten Readir
Student score as recorded by examiner						
Student score as recorded by observer						
Percent Agreement*						

*Percent Agreement Formula:

# of Items Agreed Upon
Total # of Items Completed

Figure A2. The ORAA fidelity checklist for LS.

Appendix B.

Directions: I'd like you to think about what you did over the summer. Here is a calendar. This was the last day of **last** school year (*motion to June 10*), and this was your first day of school **this** year (*motion to September 6*). Here is today. I'm going to ask you some questions about what you did over the summer. I want you to think about if you did these things never, once or twice over the whole summer, one to three times a month, one to five times a week, or six to seven times a week – almost every single day. There's no right or wrong answer.

Question	Never	Once or Twice This Summer	Every Month (1-3x/month)	Every Week (1-5x/week)	Every Day/ Almost Every Day
1. How often did you read with family members at home?					
2. How often did you read by yourself?					
3. How often did you go to the library?					
4. How often did you go to camp over the summer? (day camp or overnight)					
5. How often did you play reading games on the computer, phone, or iPad/tablet?					
6. How often did you practice spelling?					
7. How often did you practice writing?					

Figure B1. Summer activities survey for grades 1-5.

Directions: I'd like you to think about what you did over the summer. Here is a calendar. This was the last day of kindergarten (*motion to June 10*), and this was your first day of first grade (*motion to September 6*). Here is today. I'm going to ask you some questions about what you did over the summer between kindergarten and first grade. There is no right or wrong answer, and you can say yes or no.

Question	Yes/No
1. Did you read with family members at home?	
2. Did you have books at home? 2a. (If yes) Did you have some that you can read by yourself?	
3. Did you go to the library?	
4. Did you go to camp over the summer?	
5. Did you play reading games on the computer, phone, or iPad/tablet?	
6. Did you practice your letters?	
7. Did you practice writing?	

Figure B2. Summer activities survey for grade K.